WATER & SEWAGE WORKS

E ACTIVATED SLUDGE PLANT
OF TENAFLY, N. J.

Ten Years of Service Prove the Efficiency of

CHAPMAN

Beamed Waterway Gate Valves

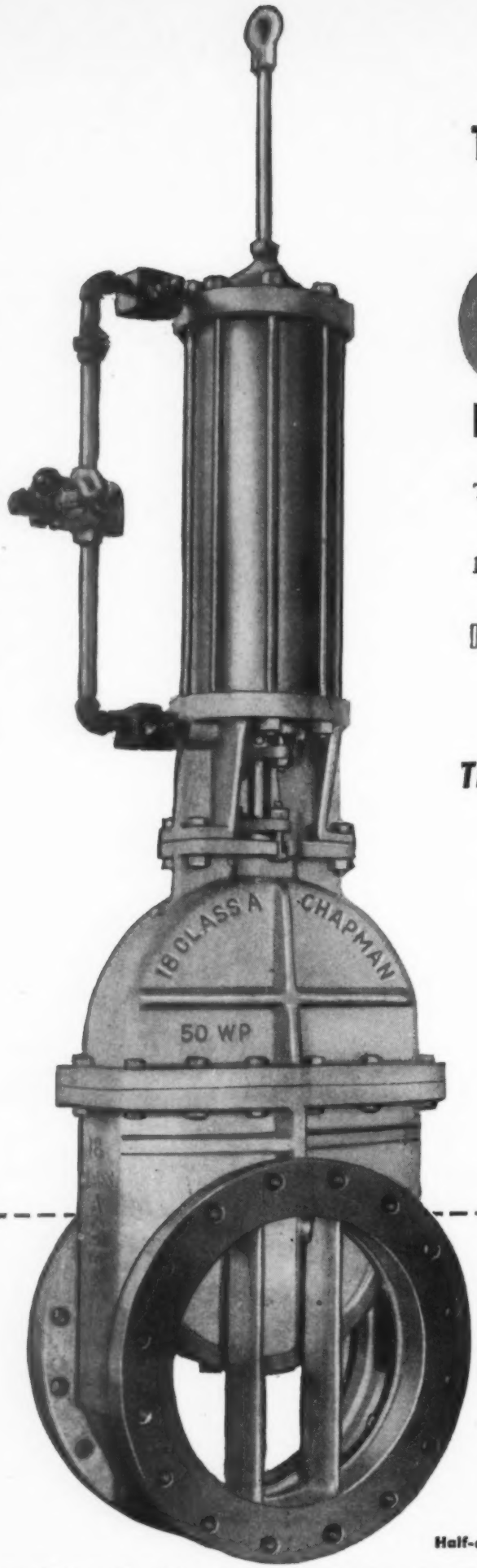
Tested in actual operation for more than ten years, Chapman Beamed Waterway Gate Valves have conclusively proved their superiority over double disc, parallel seated gate valves used under throttling conditions.

☞ Reports on Chapman Beamed Waterway Gate Valves from Water Filtration Plants are now available for engineers.

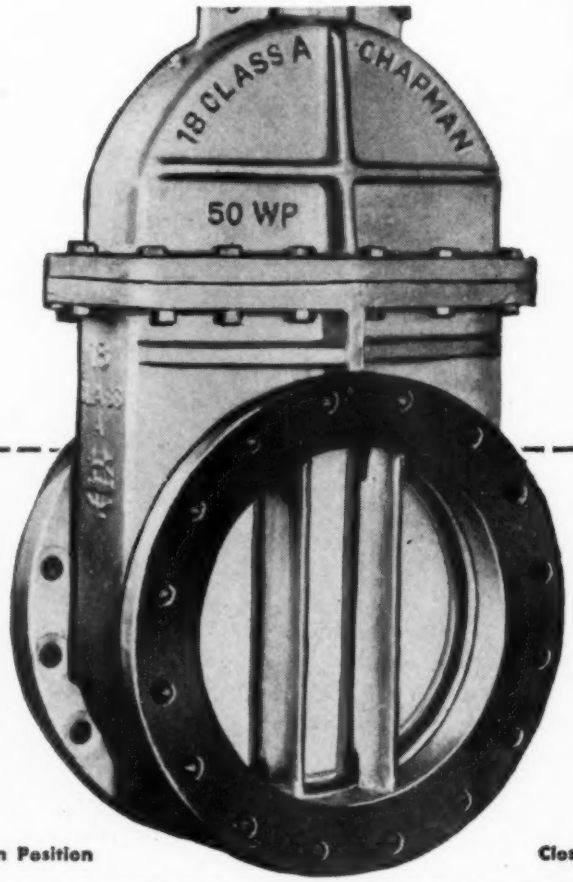
Write to:

The Chapman Valve Manufacturing Co.

INDIAN ORCHARD, MASSACHUSETTS



Half-open Position



Closed Position

WATER AND SEWAGE WORKS, June, 1946, Volume 93, Number 6. Published monthly by Gillette Publishing Co., 330 South Wells Street, Chicago, Ill. Per copy, 25c. Subscription rate, United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, March 12, 1946, at the Post Office at Chicago, Ill., under act of March 3, 1879.

2 BIG CONTESTS

$2,000 in CASH PRIZES

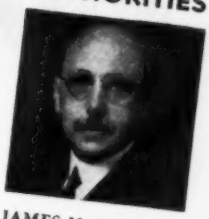
SPONSORED BY

PITTSBURGH EQUITABLE METER DIVISION
ROCKWELL *Manufacturing Co.*

To Stimulate **THINKING** *about the Community Benefits resulting from*

100% METERING

THESE *Water Works* AUTHORITIES WILL JUDGE ALL ENTRIES



WILLIAM W. BRUSH, Editor of *Water Works Engineering*; former Chief Engineer, Bureau of Water Supply, Greater New York. Past President of A. W. W. A. Graduate of New York University.

JAMES H. KENNON, Managing Engineer of the Bureau of Water of the City of Pittsburgh, Pennsylvania. Active member of A. W. W. A. Graduate of Ohio Northern University.

ALBERT E. PAXTON, Publisher of *Engineering News-Record*. Vice President of the Water and Sewage Works Manufacturers Association. Graduate of University of Illinois.

CONTEST RULES AND REGULATIONS

Everyone is eligible to participate except employees and members of their families of any DIVISION or SUBSIDIARY of ROCKWELL MANUFACTURING COMPANY and their Agents.

All entries must be accompanied by coupon clipped from any contest announcement. Only one coupon is required to identify a contestant who submits a number of entries at the same time.

Write on one side of paper only. *DO NOT* put name or address on any entry. An executed coupon will serve as contestant's identification.

Contests close August 31, 1946. Entries must be postmarked on or before that date.

Winners names in both contests will be posted in Pittsburgh-Empire Meter exhibit booths at the fall water works conventions. Checks will be mailed to winning contestants immediately upon completion of judging.

The decisions by the judges will be final and no entries will be returned. In case of ties, duplicate prizes will be awarded.

Complete the last line of this jingle

Water works systems should not be neglected,
All other utilities are meter protected.
When water is wasted, costs run high;
The mounting deficit makes taxpayers cry.
100% metering is the only fair way,

This one's a snap—the only meter you need to understand is found in poetry. Study the tips listed on this page. Then write an informative last line for the jingle. As an example, the missing line could read:

"To charge consumers, make water plants pay."

You can submit as many last lines as you wish.

PRIZE LIST

1st Prize—$500.00
2nd Prize—$250.00
3rd Prize—$100.00
4th Prize—$ 50.00
10 Consolation Prizes of $10.00 each

Write a paper not exceeding 2,000 words in length on the subject

"How A Community Is Benefited By Metering All Services"

Come on you water works superintendents, municipal officials and engineers; this subject is made to order for you! Either write about your own universal metering experience or outline your theories on the advantages of metering all services. Logic and clear thinking will count as much as past metering experience.

Contestants will, at the discretion of the Editor, be offered a $25.00 cash release fee for the use of their papers in the Pittsburgh-Empire Water Journal.

PRIZE LIST

1st Prize—$500.00
2nd Prize—$250.00
3rd Prize—$100.00
4th Prize—$ 50.00
10 Consolation Prizes of $10.00 each

TIPS ON ADVANTAGES OF 100% METERING

Metered consumers only pay for the water that is used —not for someone else's waste.

Metering discourages water waste—often cuts per capita distribution in half—conserves power, lowers treatment costs.

100% metering, by eliminating extravagant use of water, frequently curtails the need for costly added sources of supply.

By metering all services the burden caused by excessive wasted water on overloaded sewage disposal systems can be relieved.

Meters produce added revenue, usually enough to cover initial investment, maintenance costs and depreciation.

The meter system provides the only fair and equitable basis for apportioning water charges to all consumers.

Use this Coupon . . .

All entries must be accompanied by coupon filled in with name and address. Clip, pin or staple to entry sheet or sheets. Upon receipt a code number will be assigned to each contestant and this number alone will appear when subject matter is being considered by judges. Only one coupon is required to identify contestant submitting a number of entries at the same time.

Tear Out THIS COUPON NOW!

PITTSBURGH EQUITABLE METER DIVISION
ROCKWELL MANUFACTURING CO.
400 N. Lexington Ave., Pittsburgh 8, Pa.

Attached find my entry or entries for
CONTEST NO. 1 ☐ CONTEST NO. 2 ☐
Check in boxes provided. Where entries are submitted in both contests, check both boxes.

Your Name _____ Title _____

Business Connection _____

Street _____

Town _____ State _____

CONTESTS CLOSE AUGUST 31, 1946

INSTANT CONTROL means

...New Westinghouse "Six-in-One" Unit Concentrates All Power and Control Centers Within Reach of the Waterworks Operating Engineer.

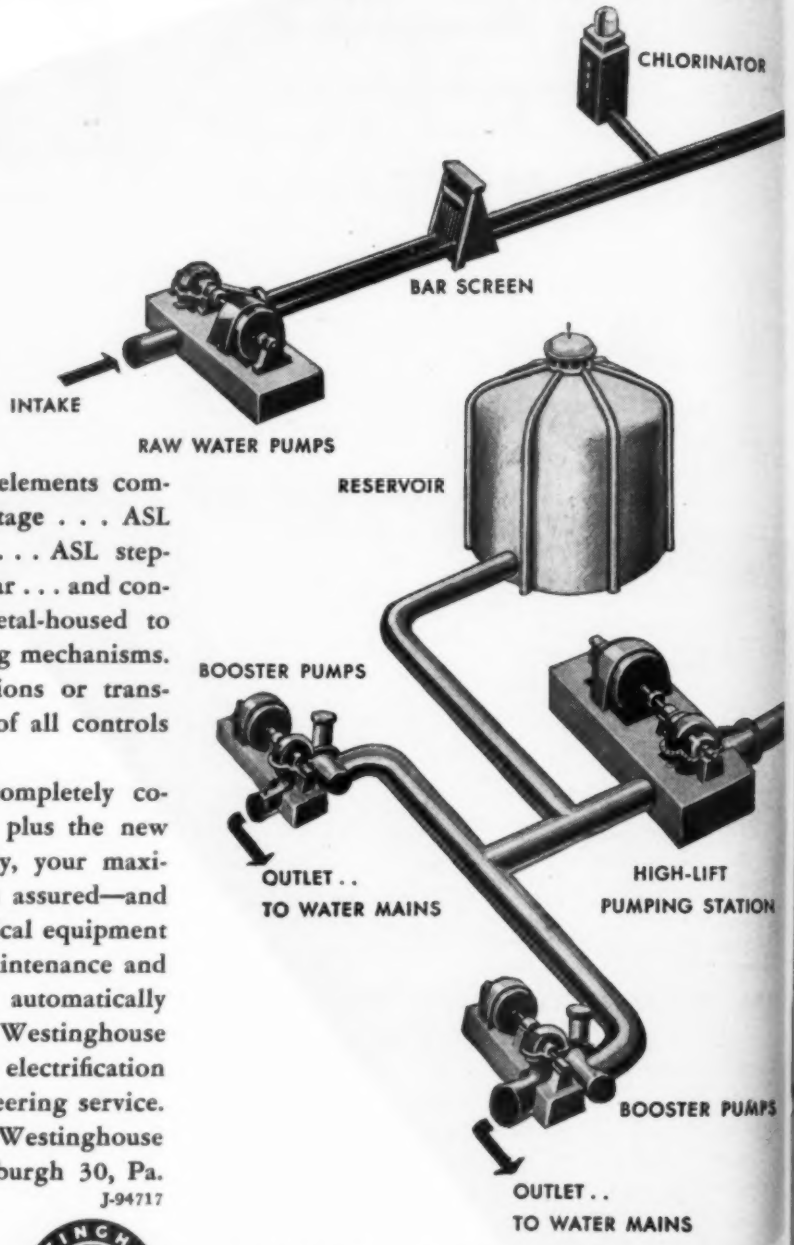
New as the latest development on your modernization blueprints, this Westinghouse control assembly for the first time co-ordinates and concentrates all electrical drive controls in one spot, within view and within reach of the operator. Instant control is the result.

Six standard, time-tested Westinghouse elements comprise the assembly: incoming primary voltage . . . ASL air-cooled transformer . . . 2300-v feeder . . . ASL step-down transformer . . . low-voltage switchgear . . . and control centers. Sections are individually metal-housed to reduce accident hazard and protect operating mechanisms. Installation is simple, no special foundations or transformer vaults required. High accessibility of all controls reduces inspection time and maintenance.

With Westinghouse Electrified Drive, completely co-ordinated from intake to booster pumps, plus the new Westinghouse Power-and-Control Assembly, your maximum operating efficiency and continuity is assured—and engineering time is saved. With your electrical equipment all-Westinghouse, the 34 Westinghouse Maintenance and Repair Plants throughout the country, automatically become your maintenance department, and Westinghouse—with decades of experience in waterworks electrification—becomes your source of specialized engineering service.

Call your Westinghouse office or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-94717

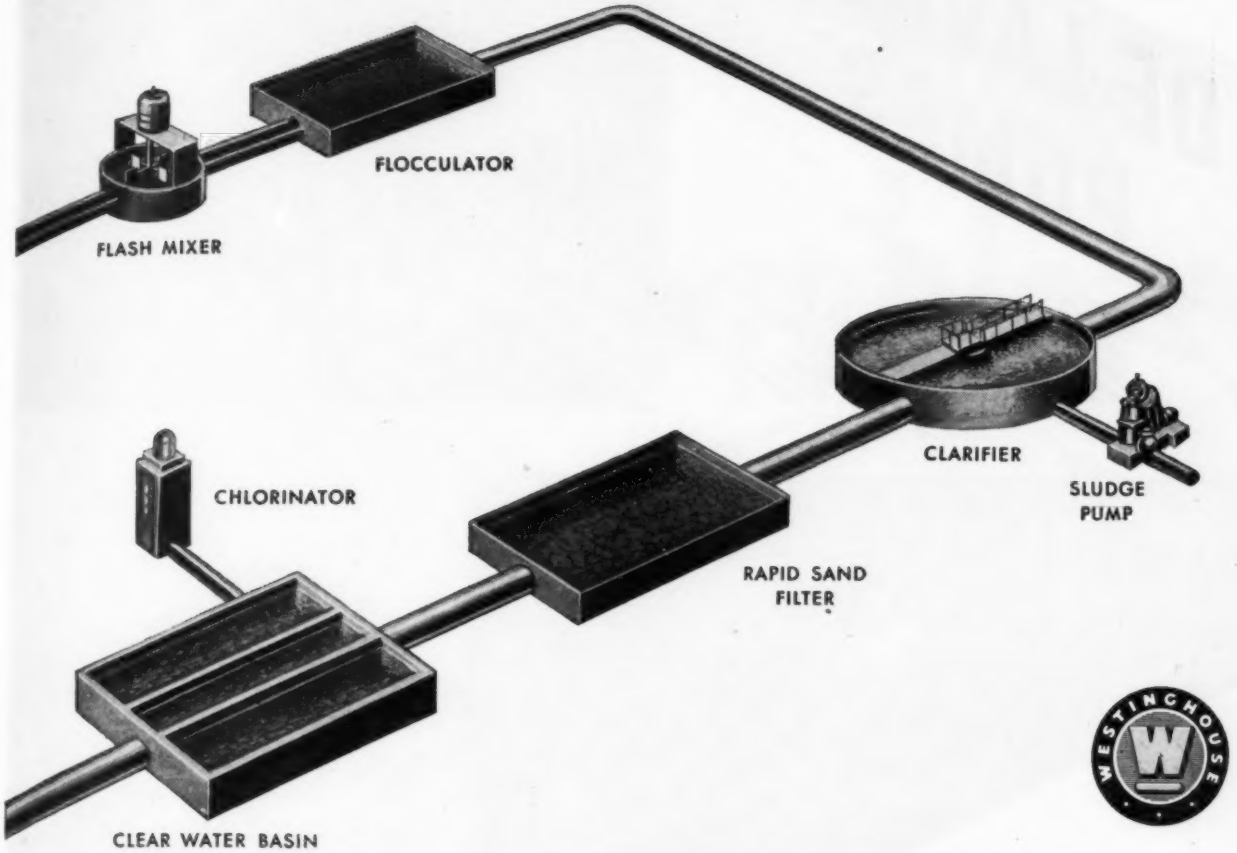


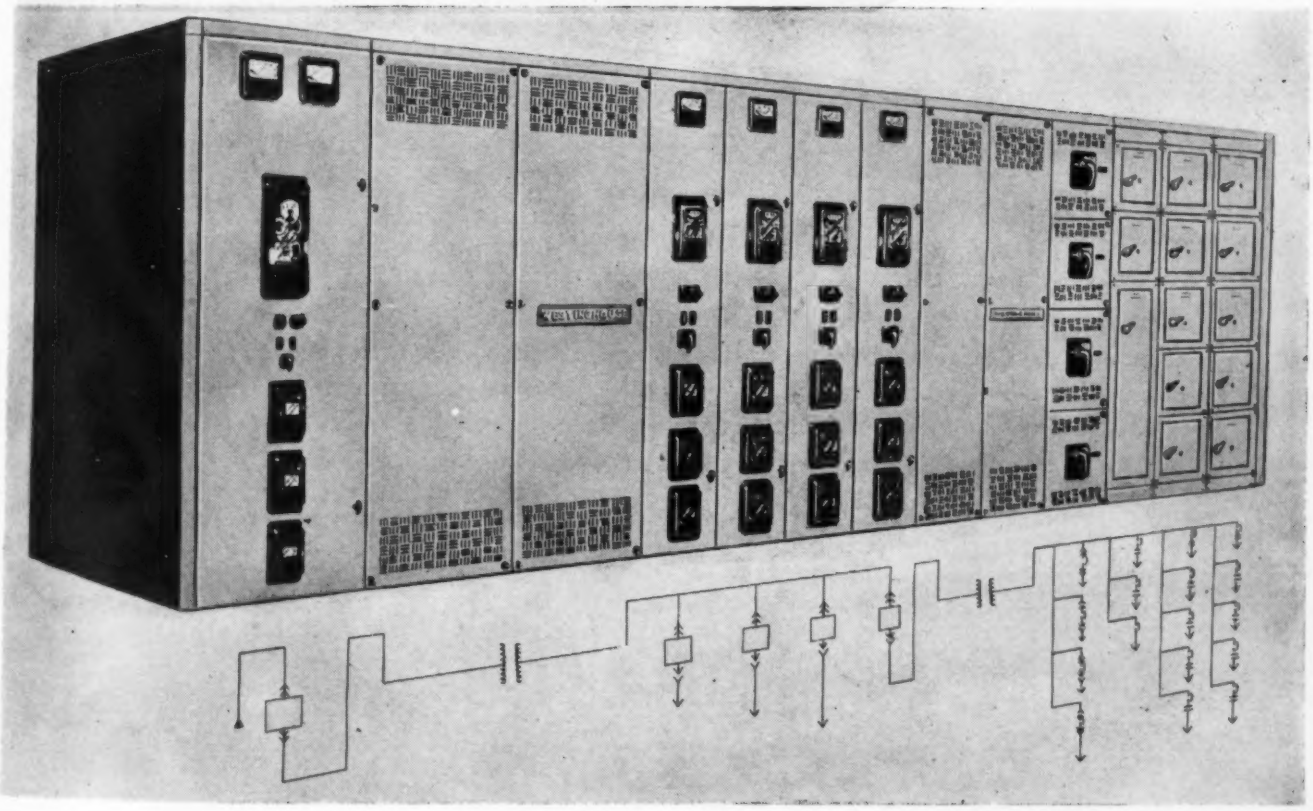
COMPLETE ELECTRICAL EQUIPMENT FOR WATERWORKS

Westinghouse
PLANTS IN 25 CITIES... OFFICES EVERYWHERE

Power flow behind the waterflow...Westinghouse

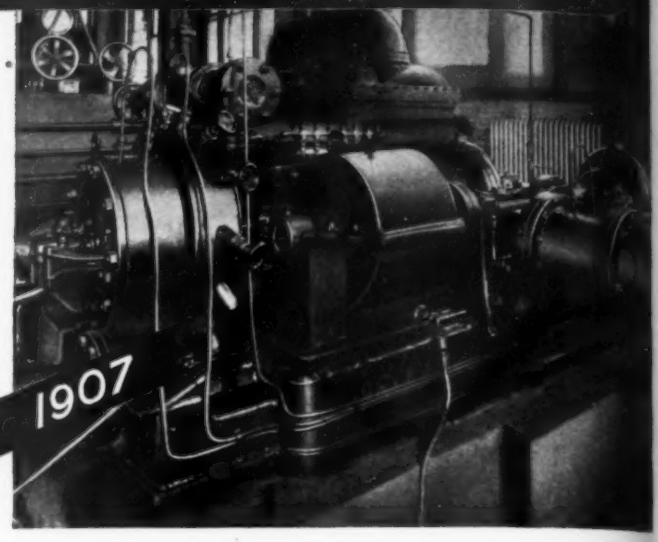
CONTINUOUS OPERATION

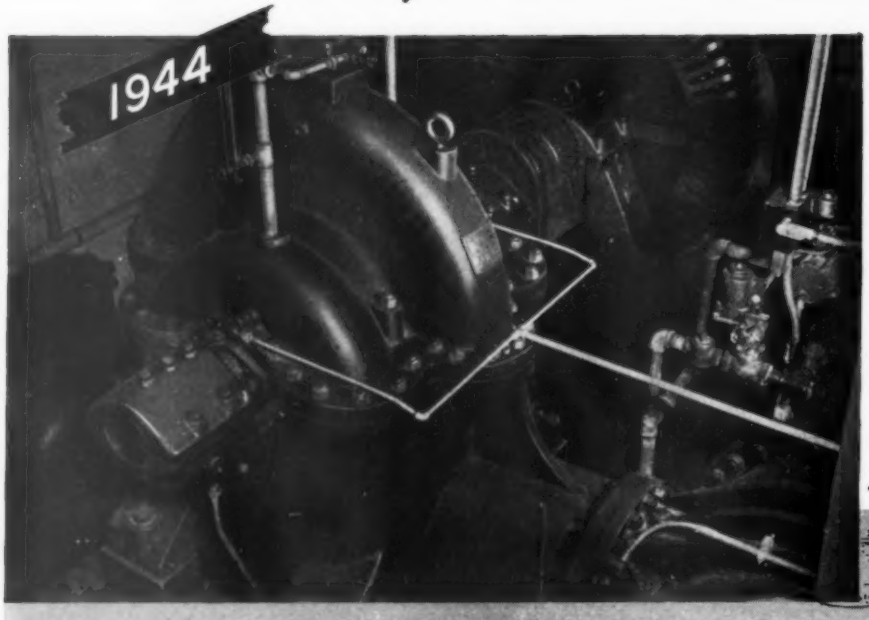




Sustained Efficiency Year after Year Brings Repeat Orders Year after Year

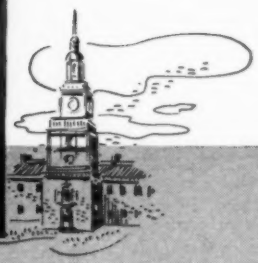
DE LAVAL PUMPS *at Philadelphia*





1907 *De Laval turbine-driven pump installed at Torresdale Station, Philadelphia in 1907.*

1944 *De Laval 25 m.g.d., 245 feet head pump installed at Lardners Point Station, Philadelphia in 1943.*



Since the installation of the first De Laval centrifugal water works pump at Philadelphia in the year 1907, that city has purchased a total of 37 pumping units from De Laval, so satisfactory has been their performance. The repeated installation of De Laval pumps by that city has been due in no small measure to the high sustained efficiencies maintained over long periods of use by De Laval pumps—a fact substantiated by tests made on two units at the Showmont Station, Philadelphia, where no measurable loss of efficiency was evident after six years of service.

4714

TURBINES · HELICAL GEARS
WORM GEAR SPEED REDUCERS
CENTRIFUGAL PUMPS · CENTRIFUGAL BLOWERS and COMPRESSORS · IMO OIL PUMPS

DE LAVAL

STEAM TURBINE COMPANY · TRENTON 2, NEW JERSEY

SALES OFFICES ATLANTA · BOSTON · CHARLOTTE · CHICAGO · CLEVELAND · DENVER DETROIT · HELENA · HONOLULU · HOUSTON KANSAS CITY · LOS ANGELES · MANILA MONTREAL · NEW HAVEN · NEW ORLEANS NEW YORK · PHILADELPHIA · PITTSBURGH ROCHESTER · ST. PAUL · SALT LAKE CITY · SAN FRANCISCO · SEATTLE · TORONTO · TULSA VANCOUVER · WASHINGTON, D.C. · WINNIPEG
And Cities in Central and South America

FIRST AID FOR WATER MAINS!

Perchloron

REG. U. S. PAT. OFF.

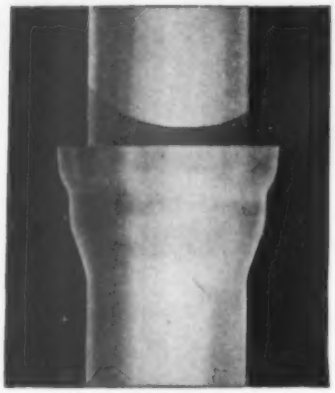
Instantaneous sanitizer for emergency breaks!

The breakage of a water main at any point allows pol... to enter the water supply. *Perchloron* added to the water safeguards the supply by aiding in the elimination of such pollution.

Water works engineers have found *Perchloron* a dependable stand-by for just such emergencies because of its quick solubility, greater stability and high chlorine content.

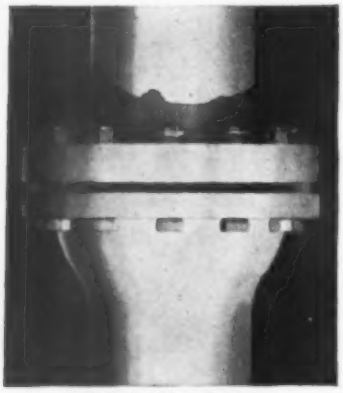
In the water purification field, PERCHLORON is also used to sanitize small water systems, new mains, wells and swimming pools. Its properties include the oxidation of ferrous iron in water, the removal of hydrogen sulphide, the control of most types of algae and the destruction of chlorine susceptible bacteria.

PERCHLORON has been released by the military and is now available. Orders will be filled as promptly as we can meet demands.



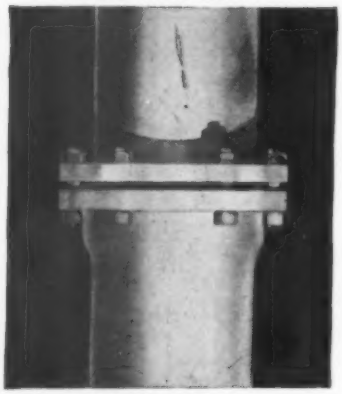
A JOINT

Bell-and-spigot Joint—the time-tried and standard for water and sewerage service.



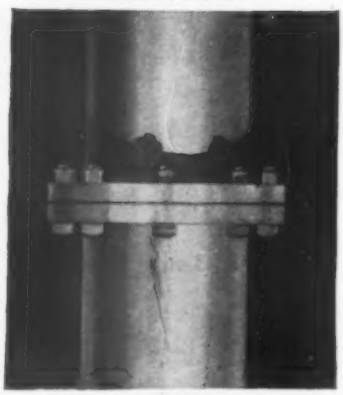
FOR EVERY

Flexible Joint—for river crossings and other sub-aqueous installations.



SERVICE

Mechanical Joint—now standardized with interchangeable parts.



NEED

Flanged Joint—for water, steam, oil or gas lines, generally used above ground.

Why Cast Iron Pipe

Reports from 43 of America's largest cities show that in 38 cities some or all of the original cast iron water mains are still in service—and they are from 60 to 124 years old!

In many ways, cast iron pipe, as represented by these old mains, is like "paid-up" life insurance.

A life insurance policy which is paid-up in 30 years, remains in force for life with no further payments—has a cash value at all times — and at age 96, is automatically payable in full.

A cast iron water main, in 30 years or less, can be amortized—or any bonds issued to finance its cost can be retired — out of revenue; then it owes the community nothing and continues in service. A cast iron main, no longer needed, has a cash salvage value — can be, and has been, sold by one municipality to another for re-use, or can be sold as scrap. And at age 96, a cast iron water main has not only paid for itself in heaping measure, but goes blithely on its way for a century or more of additional service.

It's a grand and glorious feeling to know that you are insured for life without any more premiums to pay. And it must be equally satisfying, to the water works superintendent who buys cast iron pipe, to know that it offers his community the best possible insurance of dependable and economical service. Cast Iron Pipe Research Association, T. F. Wolfe, Research Engineer, Peoples Gas Bldg., Chicago 3.

CAST IRON PIPE

is like "paid-up Insurance"

Certain forms of life insurance become paid-up in 30 years and remain in force for life with no further payments.

Serves for Centuries

Westco Turbine Pumps

Fairbanks-Morse Centrifugal Pumps

How much does it cost to make a Pump?

It costs a lot of money to make any pump—especially if you want to be a leader, not a follower, and to build a pump so efficient, so dependable that it will be second to none.

You pay the expense of maintaining well-staffed laboratories for product investigation and research—for continuous search for high efficiencies, better applications—and for the thorough testing of your finished product.

You pay the expense of providing production facilities and techniques; you pay for new materials, new methods which, with the cost-reducing benefits of mass production, assure your customers of greatest satisfaction.

Finally, you've the problem of making it easy for your customers to reach you for sales, service and consultation; you must network the country with distribution centers manned by experts.

Yes, all this costs a lot of money. No wonder, then, that there are so few pump manufacturers with this valued background. Among them, Fairbanks-Morse is an unquestioned leader in all phases of liquid-moving service . . . For all pumping problems, first see your Fairbanks-Morse dealer or call at the nearest Fairbanks-Morse branch office.

Fairbanks-Morse Propeller Pumps

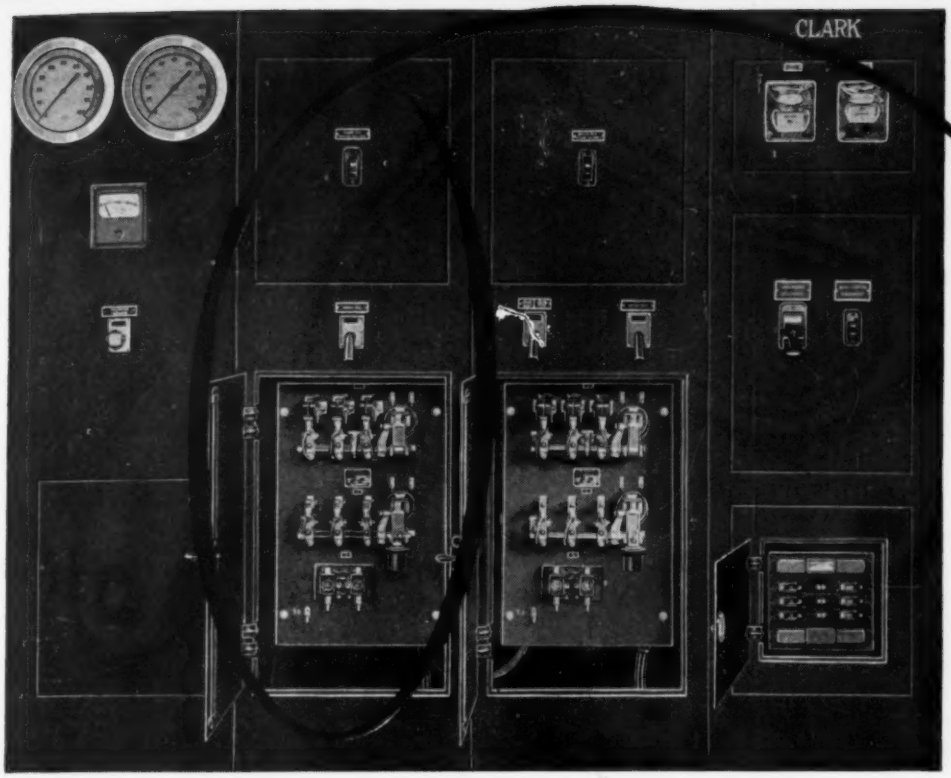
Fairbanks-Morse and Pomona Deepwell Turbine Pumps

FAIRBANKS-MORSE

A name worth remembering

DIESEL LOCOMOTIVES • DIESEL ENGINES • MAGNETOS • GENERATORS • MOTORS • PUMPS
SCALES • STOKERS • RAILROAD MOTOR CARS and STANDPIPES • FARM EQUIPMENT

presents STANDARD CUBICLE CONTROL CENTERS FOR SEWAGE DISPOSAL AND WATER TREATMENT PLANTS

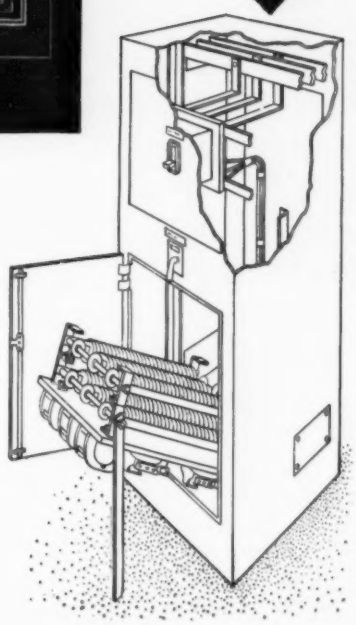


Here is a definite step forward in the design of cubicle control equipment for sewage disposal and water treatment plants. The three basic panel forms—Incoming Line, Motor Control and Gauge Cubicles—are made to match in overall height, depth, general construction and appearance. Other features include—

- Unit construction—Dead front steel panels.
- Flood space, 12" minimum.
- Physical arrangement flexible to suit any installation requirements.
- All maintenance possible from front.
- Continuous bus and pilot circuit wiring arrangements.
- Overload and short circuit protection for each motor.
- Swing-out construction on reduced voltage equipment (see sketch).
- Primary resistance type reduced voltage starting with non-breakable "3C" resistors.
- Station lighting from separate line or through transformer from Power Line.
- Power Company metering equipment can be accommodated on In-Coming Line Cubicle.
- Space provision for group mounting of flow meters, station clocks, recording and indicating gauges.

Write for "3C" Bulletin 9900 giving complete description, specification forms, outline dimensions and instructions for selecting proper cubicles.

Three dimensional cutaway view of Motor Control Cubicle, showing sturdy switch-gear type construction, arrangement for continuous bus, and swing-out feature of reduced voltage starting panels.



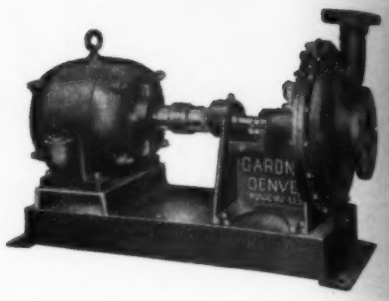
THE CLARK CONTROLLER CO.

1146 EAST 152nd ST., CLEVELAND 10, OHIO • EVERYTHING UNDER CONTROL

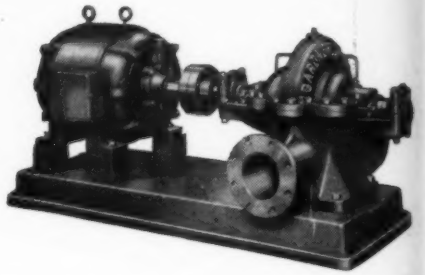
In the *Higher Efficiency* Brackets...

The smoothness and evenness with which water flows through your pump has a lot to do with pumping costs. In Gardner-Denver centrifugals, rigidly controlled foundry practices assure absolutely smooth water passages. Furthermore, these passages are properly proportioned to eliminate unnecessary eddies, back-waters and sudden changes in velocity. This—plus the inclusion of every other worthwhile hydraulic and mechanical feature—is why Gardner-Denver centrifugals are in the higher efficiency brackets. For complete information, write Gardner-Denver Company, Quincy, Illinois.

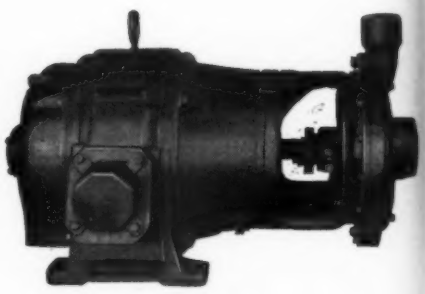
GARDNER-DENVER
Since 1859



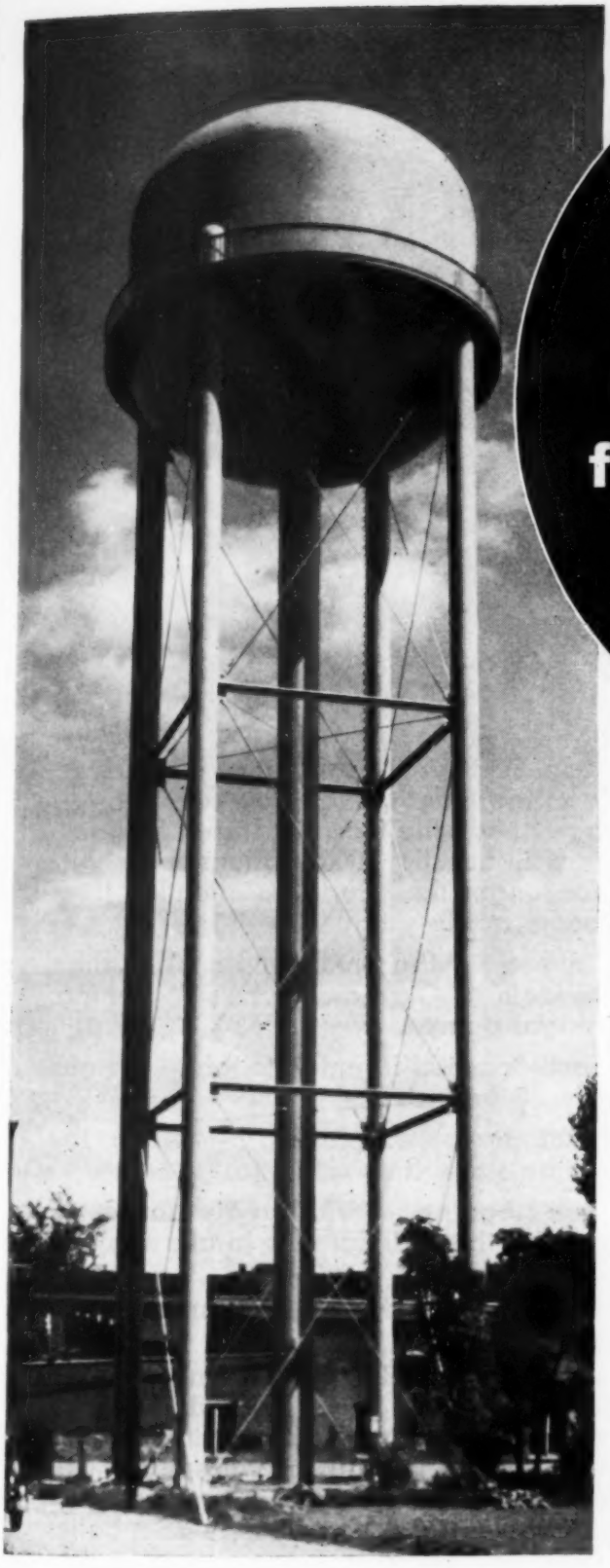
Side Suction. *Designed for general service, these Gardner-Denver Side Suction Pumps are low in first cost, as well as in installation costs. Capacities up to 2.3 million gallons per day, or 1600 gallons per minute, can be handled in heads up to 100 feet.*



Double Suction. *Gardner-Denver Double Suction Single-Stage Centrifugal Pumps cover all heads up to 300 feet. These pumps have a horizontally split case for easy accessibility. Wearing rings are easily checked. The entire rotor assembly can be removed without disturbing the motor or piping, or exposing the bearings.*



Close Coupled. *In these Gardner-Denver Centrifugals, pump and motor are combined to form a complete, compact unit. Pumps can be installed in any position—on floor, wall or ceiling. These centrifugals are designed for capacities up to 250 gallons per minute, and heads up to 250 feet.*



New HORTON TANK for Pittsfield, Illinois

. . . as city outgrows old 35,000-gal. elevated tank

Prior to October of 1945, the City of Pittsfield depended upon an old 35,000-gal. tank, 70 ft. to bottom, to provide gravity water pressure in its water distribution system. When the capacity of this tank became inadequate due to increased consumption (200,000 gal. average daily), the 150,000-gal. Horton elevated tank shown at the left was erected.

The new tank is 100 ft. to bottom. It is supported on welded cylindrical columns that give the structure a streamline appearance.

The water for Pittsfield is taken from a lake located about two miles from the distribution system and pumped by 500-gpm-capacity, electrically-driven centrifugal pumps to the elevated tank which is located in the center of the city. There are 9 miles of 4 to 10-inch distribution mains in the system . . . and 2 miles of 10-inch transmission mains.

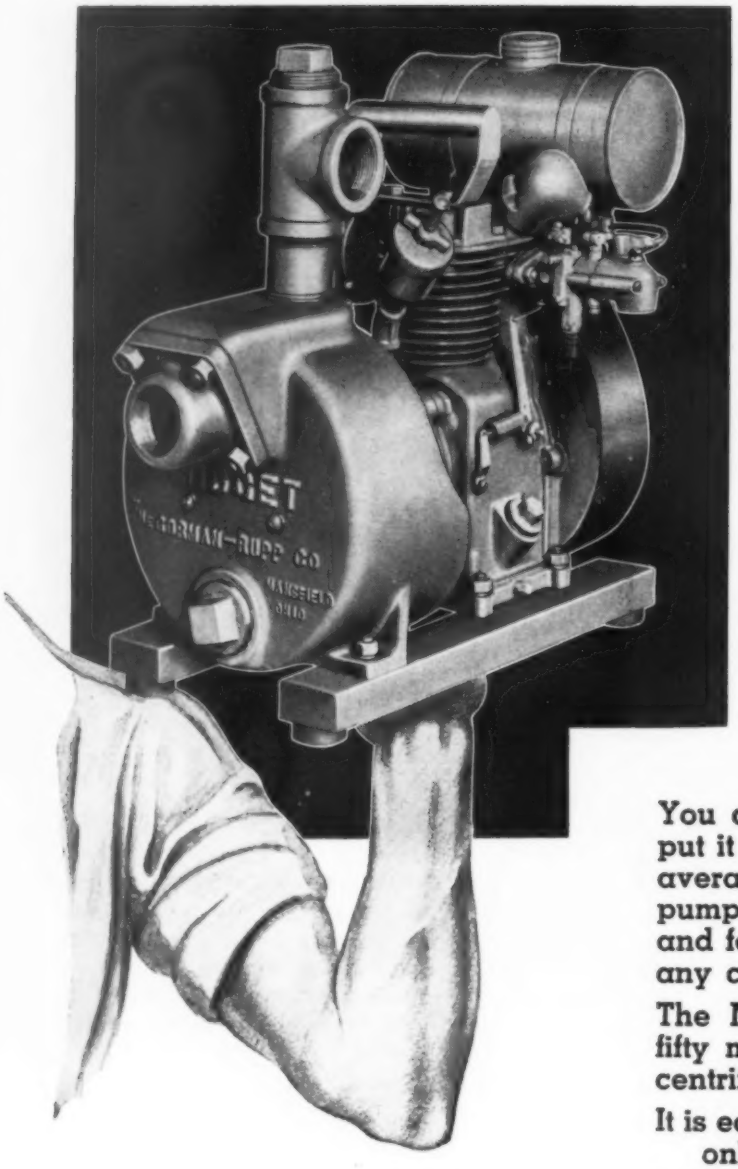
Horton elevated water storage tanks are providing gravity pressure in thousands of municipal water distribution systems. This type of water storage helps to "iron out" pressure fluctuations, provides for pumping during off-peak periods and assures a dependable supply of water for fire protection. Write our nearest office for quotations on Horton elevated steel tanks when you are considering extensions to or modernization of existing water distribution systems.

CHICAGO BRIDGE & IRON COMPANY

Chicago 4.....2198 McCormick Bldg.
New York 6.....3390-165 Broadway Bldg.
Cleveland 15.....2262 Guildhall Bldg.
Los Angeles 14.....1455 Wm. Fox Bldg.
Birmingham 1.....1586 North 50th Street
Atlanta 3.....2181 Healey Bldg.
Tulsa 3.....1646 Hunt Bldg.
Houston 1.....5615 Clinton Drive
Philadelphia 3.....1644-1700 Walnut Street Bldg.
Washington 4.....703 Atlantic Bldg.
San Francisco 5.....1283-22 Battery St. Bldg.
Detroit 26.....1551 Lafayette Bldg.

Plants in Birmingham, Chicago and Greenville, Pa.

In Canada: Horton Steel Works, Limited, Fort Erie, Ont.



A MIDGET *in size* *A* GIANT *for work*

You can lift it with one hand -- you can put it on the toughest job you can find. At average heads the Gorman-Rupp "Midget" pump will handle 3000 gallons per hour and for longer time and less attention than any comparable pump.

The Midget is the smallest of more than fifty models of Gorman-Rupp, self-priming, centrifugal pumps.

It is easily carried from job to job -- weighs only 60 pounds.

It is automatic self-priming -- when the engine starts the water starts.

It is non-clogging -- will handle any muck or solids that will pass the intake strainer.

It is economical -- pumps more per pound of pump than any other pump on the market.

Other models will handle capacities up to 125,000 gallons per hour. There is a size of Gorman-Rupp self-priming centrifugal pump to meet any pumping requirement. Our nearest distributors will send you one and let you be the judge. If it doesn't do a better job than any pump you have seen, return it at our expense.

Write for further information.

FOUR of more than 50 models of Gorman-Rupp Pumps

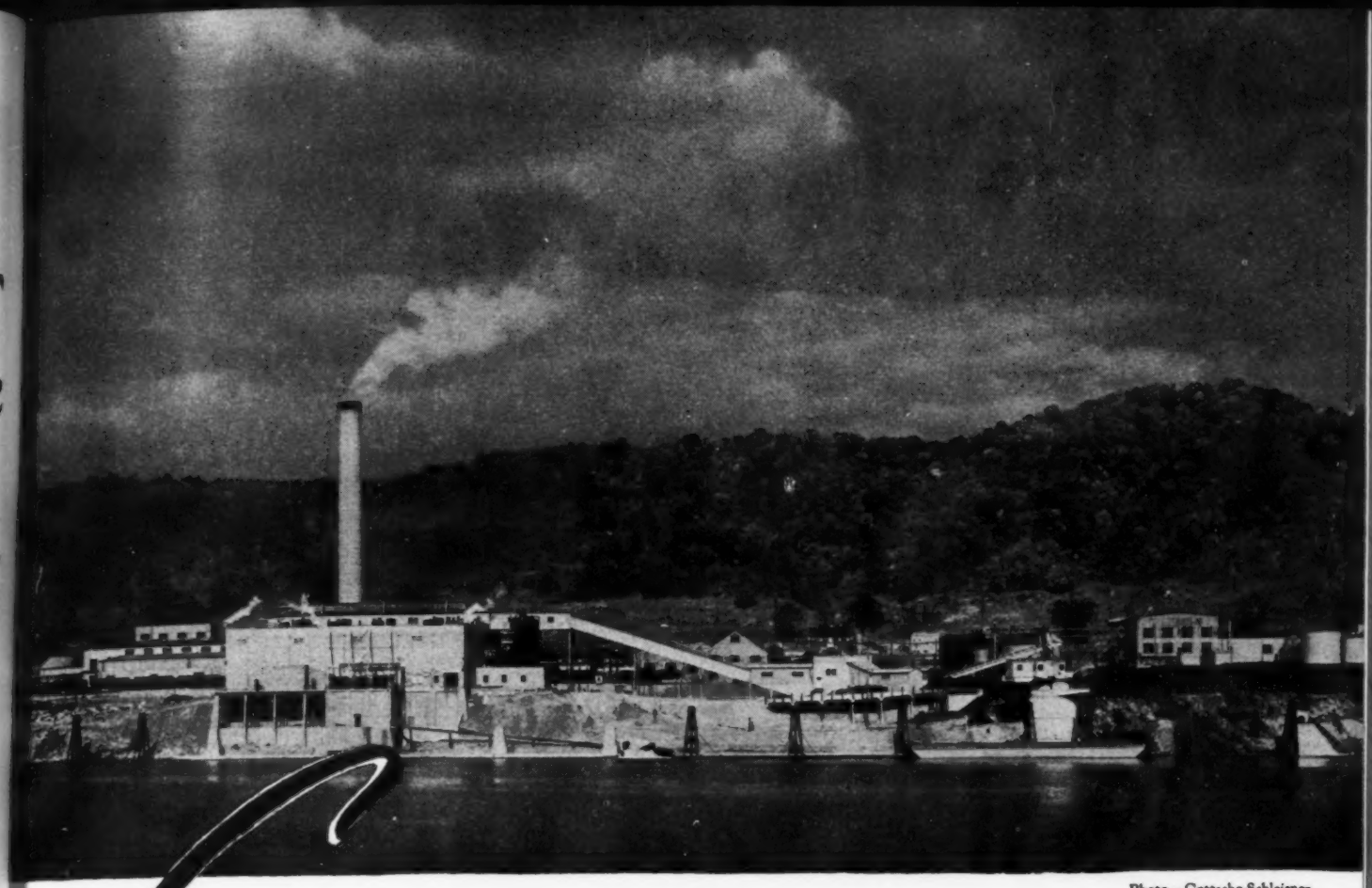
Capacity in Gals. Per Hour with pump 15 ft. above water

Total Head	Midget (60 lbs.)	Eagle (120 lbs.)	40-M (1080 lbs.)	90-M (1600 lbs.)
25	3960	11220		
30	3840	10200	34500	76800
40	3720	8400	33900	73800
50	3300	6900	32700	69600
60	2280	5100	30600	63000

For Details call your nearest distributor.

THE GORMAN-RUPP COMPANY

327 Bowman Street **Mansfield, Ohio**



Photo—Gottscho-Schleisner

Columbia buys Natrium, W. Va. Plant

The chlorine-caustic soda plant at Natrium, W. Va., has just been added to Columbia's facilities.

Built and operated by Columbia for the Defense Plant Corporation, the Natrium Plant bids to be a major factor in serving peacetime industry just as it was in producing gigantic quantities of chlorine and caustic soda for critical war industries.

This important plant, added to the facilities at Barberton, Ohio, and Corpus Christi*, Texas, is a step in Columbia's expansion program planned to meet the demand of industry for these essential chemicals.

*Southern Alkali Corporation (A Columbia Affiliate)

COLUMBIA ESSENTIAL INDUSTRIAL CHEMICALS

Soda Ash • Coustic Soda • Liquid Chlorine • Sodium Bicarbonate • Pittchlor (Calcium Hypochlorite) • Silene EF (Hydrated Calcium Silicate) • Calcium Chloride • Soda Briquettes • Caustic Ash • Phosflake • Calcene T (Precipitated Calcium Carbonate) • Modified Sodas.

COLUMBIA CHEMICALS

PITTSBURGH PLATE GLASS COMPANY
COLUMBIA CHEMICAL DIVISION
FIFTH AVENUE at BELLEFIELD • PITTSBURGH 13, PA.

CHICAGO • BOSTON • ST. LOUIS • PITTSBURGH • NEW YORK • CINCINNATI • CLEVELAND
PHILADELPHIA • MINNEAPOLIS • CHARLOTTE • SAN FRANCISCO

Will people ever say your city is "backward"?

With scientific inventions rapidly emerging, and with city planning a widespread, present-day practice, it is inevitable that the future will see great improvements made in our cities.

But no matter how completely a city may streamline itself, no matter what advances it may make, it will not be truly modern unless its sanitation methods keep pace with other developments.

Of course, you may be sure that the sanitation experts of the future will carry on the traditions of progress which you have established. And your work—protecting the health of your community from many once-common diseases, like typhoid—will serve as an inspiring example.

However, the important question is: Can future trends be forecast and planned for *now?*

We definitely believe so. Already there is evidence that the next great advance in sanitation practice will be *the combining of properly processed food wastes and*

human wastes in existing sewer systems.

This method is made possible, without interfering with present sewer systems and sewage treatment processes, by the General Electric Disposall.* This appliance, installed in home kitchens, grates food waste into fine particles and flushes them down the drain.

By becoming acquainted with the facts about this new trend in sanitation, you can take steps *today* to help make your "city of tomorrow" truly modern.

QUESTIONS AND ANSWERS ABOUT THE DISPOSALL METHOD OF FOOD-WASTE REMOVAL

1. Why should food wastes be removed this way?

Because such wastes, left in garbage cans, constitute a real menace to community health. They are odorous and putrefactive. They attract germ-spreading flies and rats.

The garbage can of today should not be tolerated any more than the outhouse of yesterday. It is just as inconvenient and unsanitary. By means of the Disposall, food waste can be removed *immediately.*

2. Do Disposall-processed food wastes clog sewer systems?

No. The Disposall grates food wastes into fine particles that flow through sewer lines without shoaling, settling, adhering to pipe lines, or causing stoppages.

Being organic matter, Disposall-processed food wastes are very similar to human wastes. But they are smaller, more water-buoyant and uniform than sewage solids now conveyed through your lines.

3. Has the Disposall idea been tested?

Yes. The first Disposalls were tested more than ten years ago. Since then, they have been subjected to constant testing under all conditions, anticipating every conceivable problem. Today, Disposalls have been installed in more than 300 communities. Results prove this idea is sound and practical.

4. Will your plant's capacity be overtaxed?

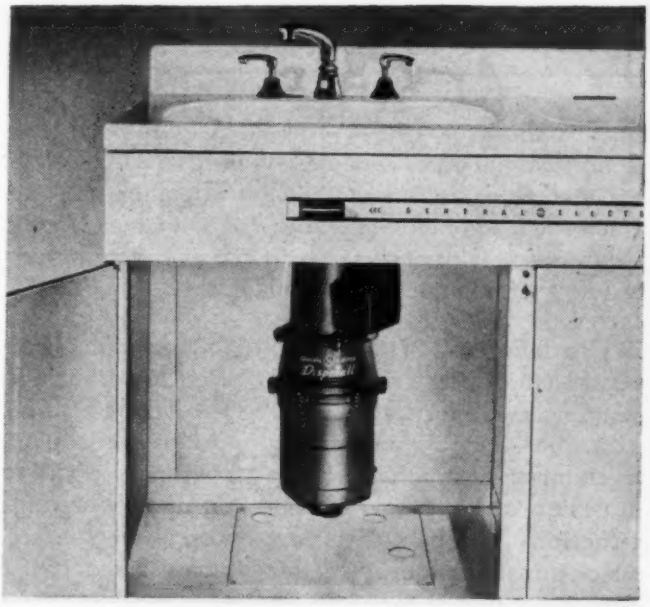
The increased volume of sewage flow caused by Disposalls would not exceed two per cent—even if they were installed in every home in your community. Disposing of food waste through the sewer system will, of course, increase the solids and organic loading on treatment plants. But it will be many years before there are enough units in use to increase appreciably the present loading on any treatment system.

5. Are sewage treatment plants necessary?

We believe that *every* city should have a sewage treatment plant. The advantages of the Disposall furnish additional reasons for the erection of such plants in communities which do not have them now.

6. How can you get more information?

If you wish to get further information or ask specific questions about the Disposall, we will be pleased to supply you with more facts. Please write, stating your request, to Department WSW646, General Electric Company, Bridgeport 2, Conn.



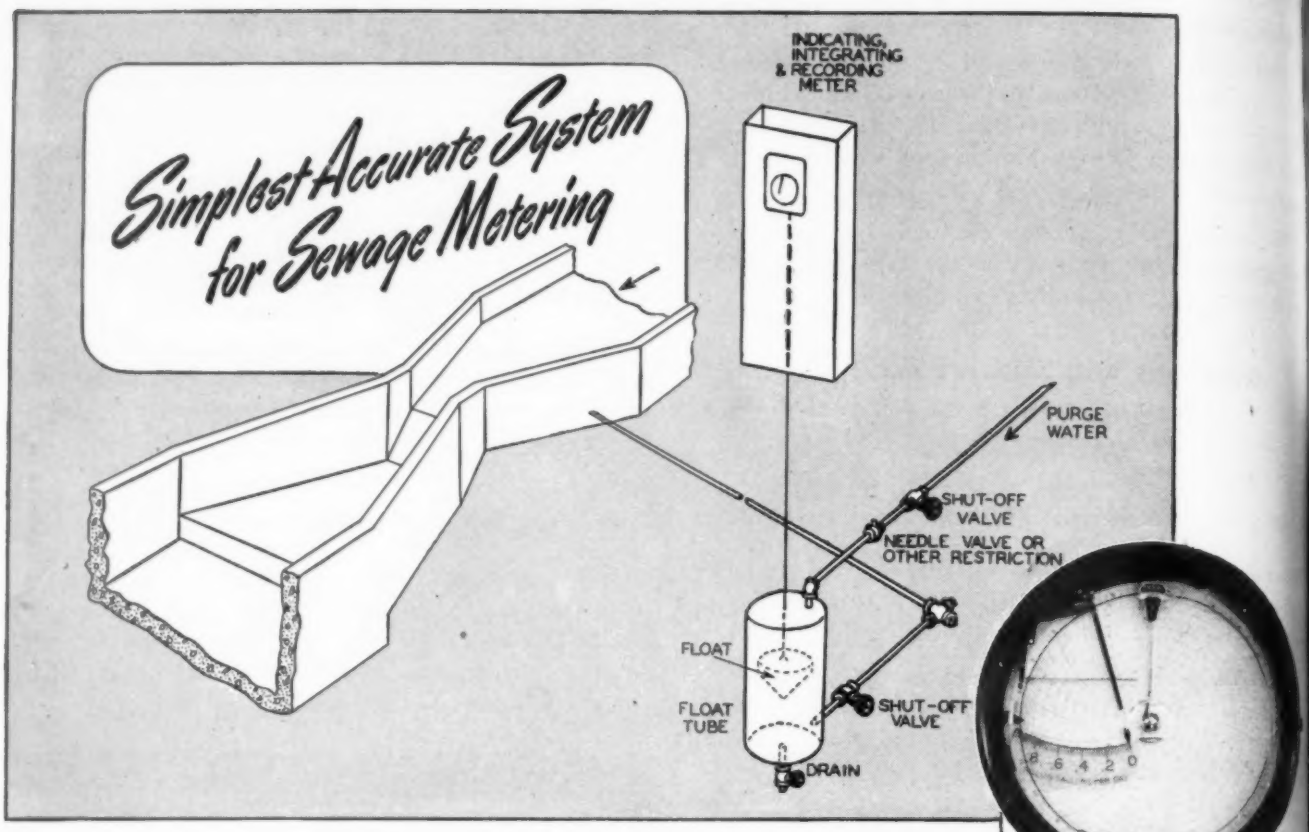
The G-E Disposall shown installed in the G-E Electric Sink. Food wastes are scraped into drain opening and safety cover placed in position. Cold water tap is then turned on, starting the Disposall operation. Food wastes are grated and flushed away, automatically.

Disposall

*REG. U. S. PAT. OFF.

CONVERTS FOOD WASTE TO SEWAGE—ELIMINATES "GARBAGE"

GENERAL ELECTRIC



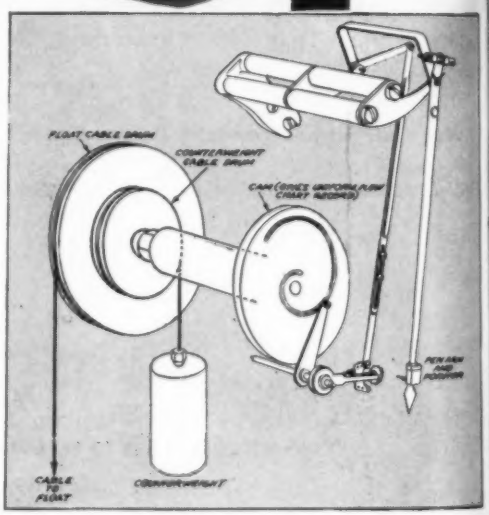
This combination of Parshall Flume and Foxboro Weir Meter records continuously and directly in UNITS OF FLOW. When you put this automatic "watchman" system on the job, there's no danger of steady increases in volume of city sewage catching you unprepared. It involves no costly purge system – no daily cleaning or fussy maintenance of instruments.

The Foxboro Weir Meter is typical of Foxboro better-engineered instruments in every respect. For example – its flow measuring mechanism is extremely simple in design and accurate in construction. The bakelite cam which translates liquid level into flow is cut from a template ten times the size of the cam to assure tool-making precision. The hardened stainless steel follower is so designed that it will always ride exactly in the center of the groove regardless of wear – assuring no appreciable change in accuracy over a long period of time.

Other features of this Foxboro Weir Meter include micrometer zero adjustment on cable drum to aid you in placing meter in operation; positive protection against overrange in case of storms; weatherproof and corrosion resistant case and mechanism. A direct-reading integrator aids in determining total flow. No complicated multipliers; ciphers added for some ranges.

Write for Bulletin A-298. Engineers will also be interested in our flow and capacity curves on flumes and weirs. **The Foxboro Company, 228 Neponset Ave., Foxboro, Mass., U. S. A.**

FOXBORO
REG. U. S. PAT. OFF.
WEIR METERS



This schematic diagram illustrates the simple, accurate Foxboro mechanism for weir metering and recording directly in units of flow.

New and interesting opportunities for organic synthesis and product improvement have been made possible by Niagara through the introduction of a fully chlorinated tetra chloro phthalic anhydride. This remarkably versatile chemical, for which Niagara has developed a special manufacturing process, possesses unique properties that can be put to practical advantage in the processing of dyes, esters, synthetic rubbers, pharmaceuticals, insulating materials, fungicides, protective coatings, lubricants, synthetic resins. Our research laboratories and technical staff are prepared to help you find ways to use this chemical formula practically and profitably.

An Essential Part of America's Great Chemical Enterprise

Niagara Alkali Company

CAUSTIC POTASH • CAUSTIC SODA • PARADICHLOROBENZENE • CARBONATE OF POTASH • LIQUID CHLORINE • NIAGATHAL

60 EAST 42nd STREET • NEW YORK 17, N.Y.

ADVANTAGES OF PRESTRESSED CONCRETE CYLINDER PIPE • NO. 4

Maximum use of local labor and materials...

• The installation of Prestressed Concrete Cylinder Pipe offers no exception to the Lock Joint Pipe Company's general practice of setting up temporary manufacturing plants near the location of projects—and using a maximum of local labor and local materials.

All necessary equipment for the manufacture of this high head pipe is transported to the temporary plant where the cylinder is fabricated, tested and lined with a substantial thickness of concrete. After a proper curing period, the lined cylinder is tension wrapped with high tensile wire and protected from corrosion by a mortar coating.

Experience on major installations in various parts of the country has proven that Lock Joint Prestressed Concrete Cylinder Pipe offers many important advantages — higher pressures in a greater range of sizes, increased elasticity, minimum weight, excellent performance and maximum water-tightness. You can profit by this experience if you consult us on all your pipeline problems.

A Hazen-Williams Hydraulic Slide Rule will gladly be sent upon request with our compliments.

LOCK JOINT
Reinforced Concrete
PRESSURE PIPE

LOCK JOINT PIPE COMPANY

Established 1905

P. O. BOX 269, EAST ORANGE, NEW JERSEY

Denver, Colo. · Chicago, Ill. · Kenilworth, N. J. · Kansas City, Mo. · Rock Island, Ill.
Joplin, Mo. · Valley Park, Mo. · Cleveland, Ohio · Hartford, Conn. · Navarre, Ohio

SCOPE OF SERVICES *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains in a wide range of diameters as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*

See them in action doing your work on your job

See how men work faster with electric tools operated by Homelite Portable generators. Test the capacity, speedy priming and operational advantages of Homelite Pumps on your toughest dewatering job.

There's only one real way to see how well a Homelite Pump handles large volumes, seepage, mud . . . or how easily a Homelite Generator supplies steady current for floodlights, cost-cutting electric tools, communication systems, etc. That way is to get 'em out on the job. Yes, get these handy portable gasoline-engine-driven units out on *your* job and see how they measure up to *your* standards. See how they work for *you*. All you have to do to get a free demonstration . . . the only way to see in advance what you should get for your money . . . is to write to us today. We'll arrange to have a Homelite Representative see you soon.

Homelite
CORPORATION
Port Chester, New York
Portable Pumps Generators and Blowers
GASOLINE-ENGINE-DRIVEN

Original Woodcut by Lynd Ward

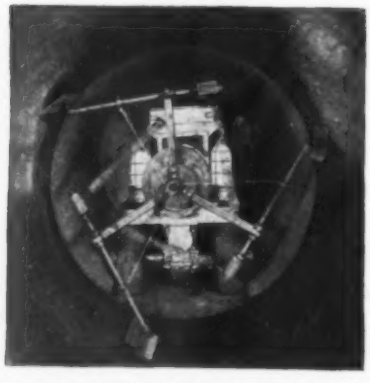
When this tree was a sapling, more than a century ago, foundrymen cast gray iron into pipe which is still in service. Their methods were primitive compared with the highly developed production techniques by which U. S. Pipe is made today. And yet, because of the service records of their product, the estimated useful life of cast iron pipe has been steadily revised upward. Cast iron pipe combines in one material all the qualities required for long-lived service—strength, toughness and inherent high resistance to corrosion.

U.S. cast iron PIPE

U. S. PIPE & FOUNDRY CO.
General Offices: Burlington, N. J.
Plants and Sales Offices throughout the U. S. A.

IN THESE five key cities, Centriline recently reconditioned over a hundred thousand feet of important water supply mains . . . with the result of an average increase of over 70% carrying capacity.

These pipelines . . . ranging in sizes from 36" to 48" and varying in ages from 25 to 51 years . . . were badly crippled and choked because tuberculation and corrosion had taken a strong hold of their hydraulic efficiency. However, Centriline men and equipment went to work and soon had them in smooth-running condition.



The Centriline process is a rapid and economical method of reconditioning pipelines. It consists of first cleaning the main, then applying by centrifugal force, a dense cement mortar lining of required thickness, mechanically troweled to a smooth finish. This is done underground, in place.

Don't wait for tests to show a decrease in carrying capacity and your budget to go off balance with costly pumping expenditures—CENTRILINE NOW! Wherever your pipeline is situated, whatever its length—if its diameter is 30" or more—our men can quickly reach and recondition it. We welcome your inquiry.

CENTRILINE PROCESS

CENTRILINE CORPORATION

148 CEDAR STREET • NEW YORK 6, N. Y.

Restores and Protects Pipe-Line Carrying Capacity

IT'S TABOO

★ TO WASTE FOOD

When you incinerate or bury your sewage sludge you are wasting a valuable product that is urgently needed to increase America's food production with more mouths to feed than ever before.

The fertilizing values in sewage sludge are not in applicable form as it comes from the drying beds. At a cost no greater than that of burning or burial, modern sewage plants are converting sludge cake into fertilizer with Royer Sludge Disintegrators, and enjoying a steady revenue therefrom.

The Royer, operated by one man, disintegrates, shreds, aerates and further dries the sludge, and automatically eliminates refuse. It discharges an effective, ready-to-use fertilizer which has proved to be a rich, nutritious plant food in all parts of the country.

Sewage plants using Royers find a ready market for their sludge fertilizer among growers of food crops, and this rugged, inexpensive machine soon pays for itself. Available in twelve stationary and portable models electric motor, gasoline engine and belt-to-tractor driven.

Send for the "Sewage Sludge Utilization Catalog"—gives sludge marketing ideas.

ROYER

PIONEERS IN THE SALVAGE OF SEWAGE SLUDGE

ROYER FOUNDRY & MACHINE CO.

170 PRINGLE ST., KINGSTON, PA.

Are *they* blaming you because the streets are bad

Patches in your city streets may be *Rough Reminders* that *obsolete pipe cleaning methods* are being used.

It's seldom necessary to tear up pavement when modern FLEXIBLE pipe cleaning equipment is used.

FLEXIBLES eliminate more than 50% of the "dig-ups" required by old outmoded methods. And when you figure costs, remember "dig-ups" are expensive.

Your Sewer Department can be modernized easily and economically with a Standard City Set of FLEXIBLE SEWER ROD EQUIPMENT. FLEXIBLES pay for themselves in a short time because they speed up work. A few men can clean more underground pipe than an entire crew working with old outmoded methods.

The "Flexible" Power Drive speeds work, operating on the same principle as ratchet turning handles, but turning rod into the pipe line continuously at about 5 times hand-turning speed.

No matter what the pipe cleaning problem is, FLEXIBLE can lick it. FLEXIBLE manufactures a complete line of tools for every type of pipe cleaning job — there are attachments for removing sand, roots, rocks, marine growths and any other pipe stoppages.

FLEXIBLES are fast, efficient and effective. Let FLEXIBLE show you how to clean underground pipes. WRITE FOR ILLUSTRATED CATALOGUE.

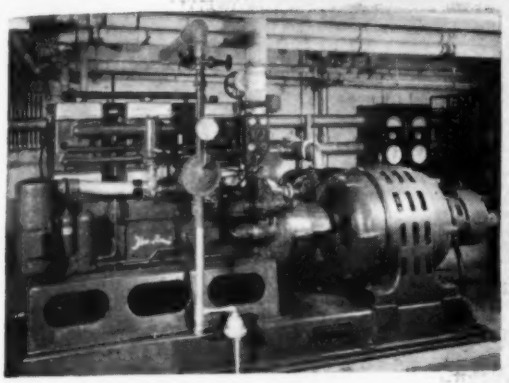
855 Board of Trade Bldg., Chicago 4, Ill.
41 Greenway St. Hamden, Conn.
228 W. Broad St., Columbus 8, Ohio
147 Hillside Ter., Irvington, N. J.
1624 Marmon Place, Minneapolis 3, Minn.
P. O. Box 694, Pittsburgh.
401 Broadway, New York 13.
P. O. Box 105, Atlanta.
29 Cordan Ave., Roslindale 31, Mass.
P. O. Box 447, Lancaster, Texas

Flexible SEWER ROD EQUIPMENT CO.

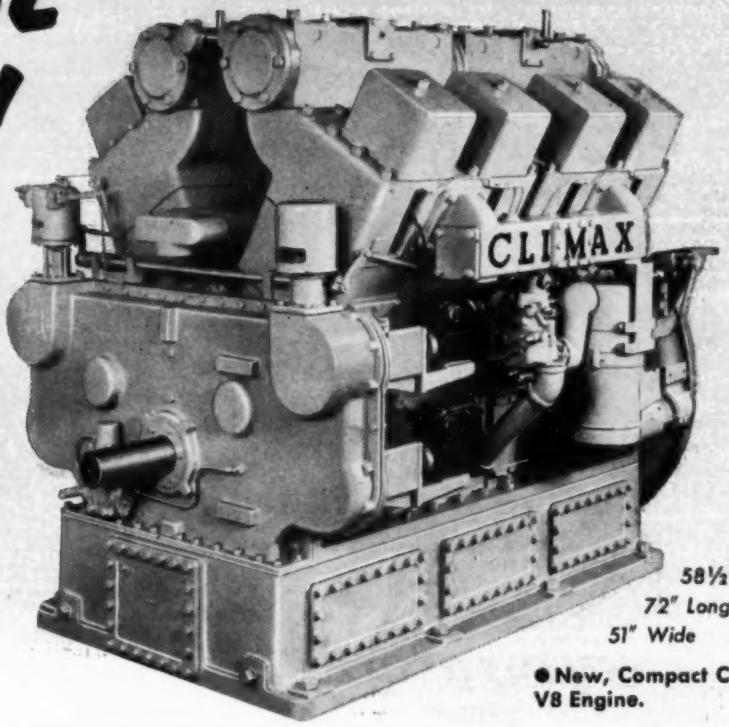
9059 VENICE BOULEVARD • LOS ANGELES • CALIF.

Ask the ENGINEERS in Waterworks and Sewage Plants about THESE ENGINES!

●200 H.P. Climax Engines Direct Connected to 4 M.G.D. Booster Pumps, Waterworks, Aurora, Illinois.



●75 H.P. Climax Sewage Gas Engine Direct Connected to Generator, Sewage Treatment Plant, Davenport, Iowa.



58½" High
72" Long
51" Wide

● New, Compact Climax V8 Engine.

★ SAMPLE COMMENTS ★

E. B. LLOYD, Chief Engineer and Chemist, Elgin City Water Department, says, "The reliability of this (Climax) standby equipment is a factor in keeping our city in low insurance classification."

SUPT. DAVID BACKMEYER, of Sewage Treatment Plant, Marion, Indiana, says, "To duplicate work done by the Climax Gas Engine in one year would require 191,000 kw hours. The three engines earned $7,771.68 in one year."

JACK STURDY, Supt. City Light and Waterworks, Tipton, Iowa. "Our Climax standby unit is 100% O.K."

CARL DUY, Engineer of Waterworks, Aurora, Illinois, (speaking of Climax Engines direct connected to 4 M.D.G booster pumps in standby service) says, "For the past two years, since this writer has been in charge of plant, we have had no maintenance cost and they operate on regular schedule."

ROY M. BROWN, Chief Engineer, Department of Utilities, Provo City, Utah. "This (Climax) unit has proven satisfactory in every respect."

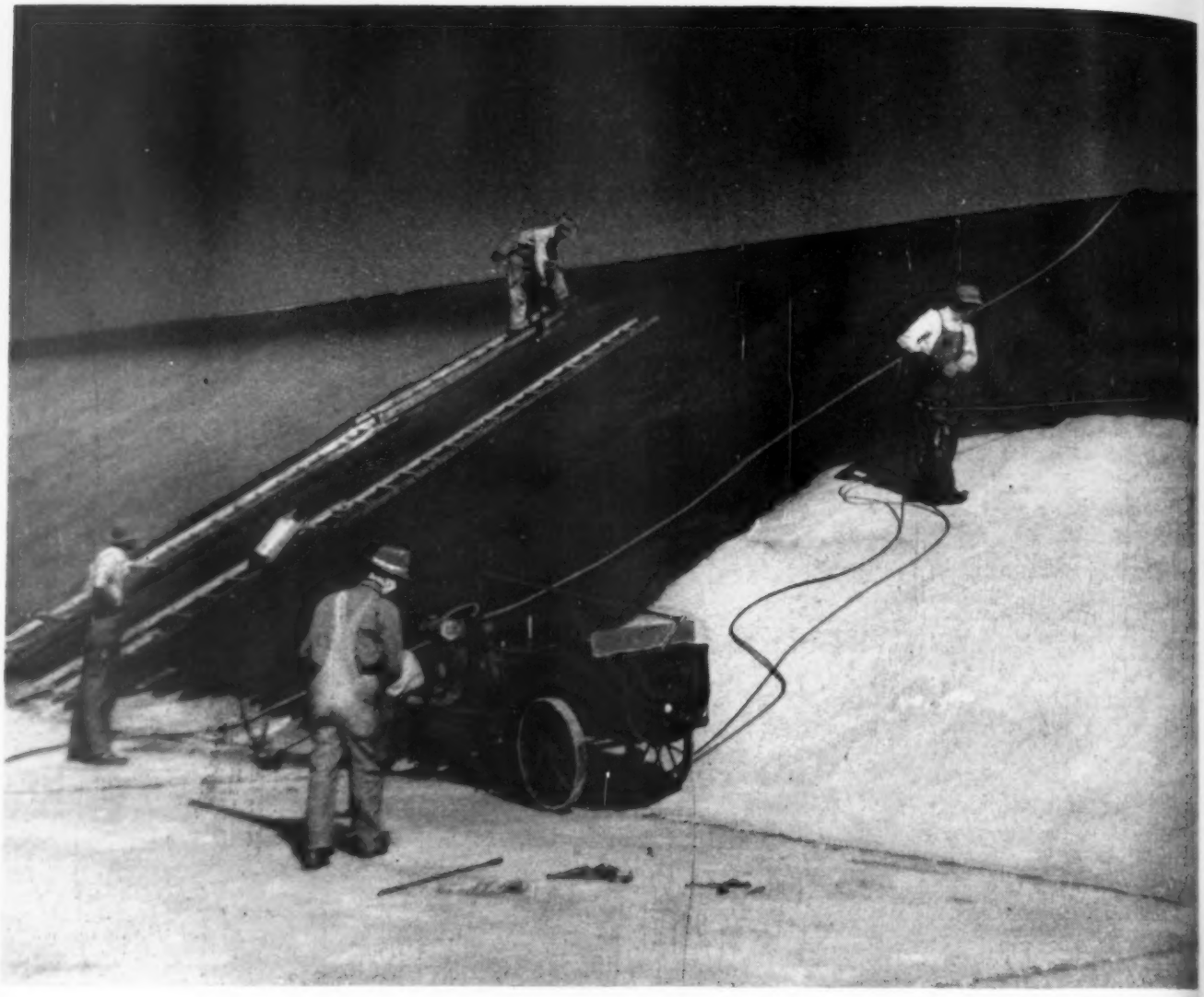
SUPT. H. T. RUDGALL, Sewage Treatment Plant, Kenosha, Wisconsin, says, "The (Climax) engines are economical because use of same provides a substantial saving over electric driven equipment."

IN WATERWORKS: In standby service, Climax Engines are not only used to supply—at a moment's notice—dependable power during purchased power outages, but—to keep down maximum demand charges for electric power during emergency periods of peak water demand. Because of their extremely low maintenance and economy of operation on natural or by-product gas, as well as on butane or gasoline, they are used as the source of *primary* power in many plants.

IN SEWAGE PLANTS: Records (available on request) of sewage plants from coast to coast affirm that Climax Engines, operating efficiently on sewage gas, have reduced power cost to the equivalent of ¼ cent per kwh. Savings thus affected have been supplemented by 50% heat recovery from jacket water and exhaust to heat digesters and buildings.

Consider Climax Engines **before approving a new installation. There are 4, 6, 8, and 12 cylinder, 4-cycle types. For complete information and specification bulletins, write Climax Engineering Company, Clinton, Iowa.**

climax
BLUE STREAK ENGINE
Builder of Climax DIESELS and GENERATING SETS
CLIMAX ENGINEERING COMPANY



Waterproofing a Concrete Reservoir Saves millions of gallons of finished water

NO-OX-ID applied to concrete basins prevents costly leakage through joints and cracks; stops cavitation of concrete due to weathering and chemical action.

A NO-OX-ID impregnated surface provides years of protection, due to its water resistance, toughness, elasticity, and nonoxidizing properties.

The recommended grade of Water Works NO-OX-ID is applied hot to either old or new concrete surfaces.

Let us survey your problem and make recommendations, without obligation.

NO-OX-ID
IRON + OX = RUST
REG. TRADEMARK
AUG. 27, 1918

The ORIGINAL RUST PREVENTIVE

Dearborn Chemical Company
Dept. Y, 310 S. Michigan Ave., Chicago 4, Ill.
New York • Los Angeles • Toronto

Niagara water tastes better

thanks to MATHIESON CHLORINE DIOXIDE

Faced with a difficult water condition in the Niagara River, water supply officials of the City of Niagara Falls turned to the use of Mathieson Chlorine Dioxide. That was over two years ago. Today, the people of Niagara Falls have a continuous supply of pure, delicious water, free of odors . . . read what the City Manager has to say about it in the letter opposite.

THE MATHIESON ALKALI WORKS (Inc.)
60 E. 42nd St., New York 17, N. Y.

CITY OF NIAGARA FALLS
STATE OF NEW YORK
OFFICE OF THE CITY MANAGER
CITY HALL

STEPHEN A. LAMB, MAYOR

COUNCILMEN:
WILBUR F. CONNELL
EARL HILTS
ANTHONY J. KELLER
AUGUSTINE B. MALONEY

ORVILLE C. BUTLER, CITY MANAGER
EDWARD T. ARNOLD, PURCHASING AGENT

March 14, 1946

The Mathieson Alkali Works, Inc.
60 East 42nd Street
New York 17, New York

Attention: Dr. G. P. Vincent, Technical Director.

Gentlemen:

It has been over two years since the Water Department here first employed the use of chlorine dioxide to correct for tastes and odors in the water supply. For nearly the same length of time chlorine dioxide has been continuously applied to the entire pumpage.

According to our plant records, except for brief and very infrequent lapses, easily and quickly corrected, the water supply has been maintained at a high level of quality throughout this period despite a difficult water condition which frequently exists in the Niagara River at this locality.

We are pleased to be able to make these favorable comments regarding our experience here with chlorine dioxide and want to take this opportunity to extend to Mathieson our best wishes for continued success in expanding its use to other water supplies.

Very truly yours,

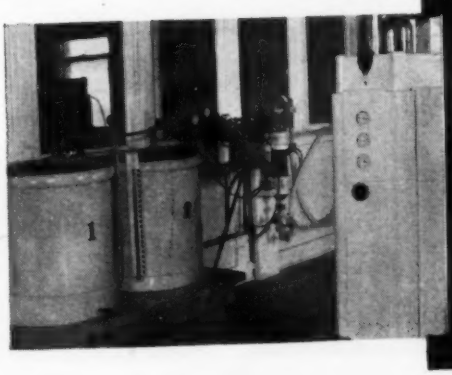
ORVILLE C. BUTLER,
CITY MANAGER.

OCB.N

ORVILLE C. BUTLER
City Manager, City of Niagara Falls

Mathieson
CHLORINE DIOXIDE

Chlorine Dioxide . . . Sanitation HTH . . . Liquid Chlorine . . . Ammonia, Anhydrous & Aqua . . . Dry Ice . . . Carbonic Gas . . . Bicarbonate of Soda . . . Caustic Soda Soda Ash . . . Fused Alkali Products . . . Synthetic Salt Cake . . . Sodium Chlorite Products . . . Sodium Methylate



FOR DETAILS OF THIS REMARKABLE TECHNIQUE FOR REMOVING OBJECTIONABLE TASTES AND ODORS FROM WATER, WRITE MATHIESON TODAY.

HOW PASSAIC VALLEY WATER COMMISSION *MAINTAINED SERVICE*

While Inserting Valve in Large Asbestos-Cement Main

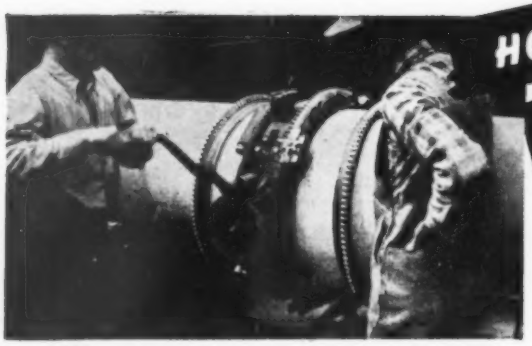
THE PROBLEM

To insert a gate valve in a 24" asbestos-cement main without interrupting water supply.

THE SOLUTION

Engineers of The A. P. Smith Mfg. Co. were asked if it were possible to make a valve insertion under pressure in a large asbestos-cement main. They answered in the affirmative and performed the job without a hitch, employing a standard Smith Inserting Valve and Machine.

HOW IT WAS DONE



1 Making initial cut partially through pipe wall.

2 Half of valve body in place. Seat rings can be seen on each side of pipe-cutting mechanism.

3 Halves of valve body and slide gate in place.

4 Temporary bonnet attached to valve body; cutter is actuated by revolving the rod extending through stuffing box. Cut-out pipe section is withdrawn into bonnet and slide gate is closed, allowing removal of temporary bonnet and cut-out pipe section.

5 Completed valve anchored in concrete valve chamber.

Note: Valve insertions can be made in cast iron, steel or asbestos-cement pipe in sizes 4" through 48".

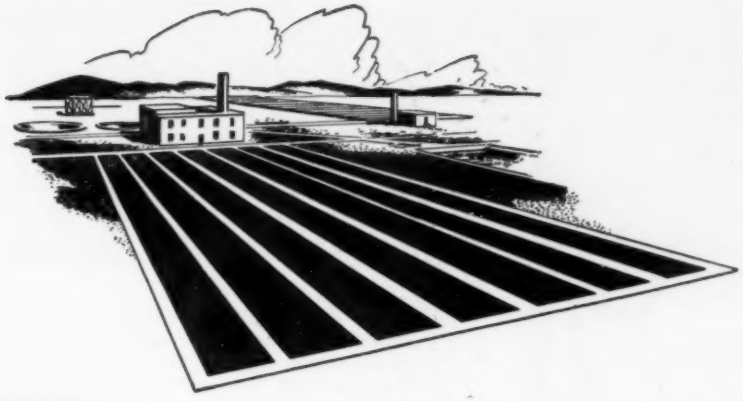
10

FIRE HYDRANTS
GATE VALVES
CHECK VALVES
INSERTING VALVES
TAPPING SLEEVES AND VALVES
WATER SERVICE BRASS GOODS

THE A. P. SMITH MFG. CO.

EAST ORANGE, NEW JERSEY

FLOOR STANDS
INDICATOR POSTS
TAPPING MACHINES
INSERTING MACHINES
PIPE CUTTING MACHINES
CORPORATION TAPPING MACHINES



MEETING DIFFUSION REQUIREMENTS of Modified Aeration

A HIGH degree of secondary sewage treatment at relatively low cost is obtained through plain aeration or reduced period activated sludge treatment. Its efficiency in removing solids and BOD reduction by bio-fluctuation are well known.

Air diffuser equipment is the heart of this process ... even as in other aeration applications. Here, the importance of correct diffuser equipment selection, suited to the peculiarities of the particular installation, cannot be too strongly emphasized. To a larger degree than any other single factor... diffusers control the operating efficiency of the entire method.

It is at this point, The Carborundum Company can offer you a definite service. Through constant contact, our engineers are familiar with the specialized character of diffuser applications. Basing suggestions on a working knowledge of tanks, blowers and piping... they are able to offer sound advice on size, shape, permeability and arrangement of diffuser equipment for each individual design. It is even quite possible that some new developments with which they are acquainted may provide a direct solution to your problems. That is why we suggest consulting them.

Many design consultants, superintendents and contractors sincerely appreciate the practical recommendations obtained through discussions with these men. We are confident you will too. There is no obligation incurred in asking them in to talk things over. They welcome the opportunity at your convenience. Write Dept. O-66 today. The Carborundum Company, Refractories Division, Perth Amboy, N. J.

DIFFUSER MEDIA

BY **CARBORUNDUM**

TRADE MARK

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

DESIGNED FOR Dependability and Durability

"VAREC" Approved Nozzle Type Angle Relief Valves are top-guided and have high capacities, featuring minimum overpressure and blow-down in *water, oil, steam, air, gas or chemical* service with pressures up to 900 P.S.I. and temperatures up to 950° F.

Available in many size and material combinations, "VAREC" Approved Relief Valves perform satisfactory service with maximum safety at minimum maintenance cost.

Thousands are in operation by U. S. Navy, Army Engineers, R.F.C., U. S. Maritime Commission, Petroleum Refiners, Petro-Chemical Plants, etc.

"Varec" approved ANGLE RELIEF VALVES

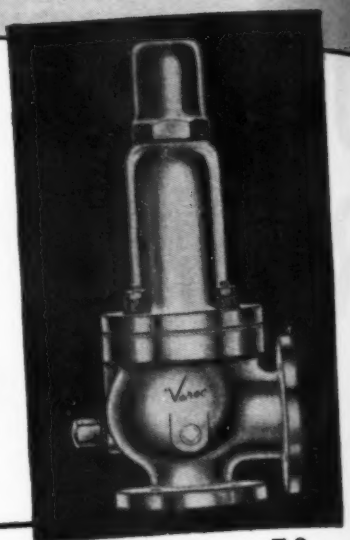


FIG No. 78

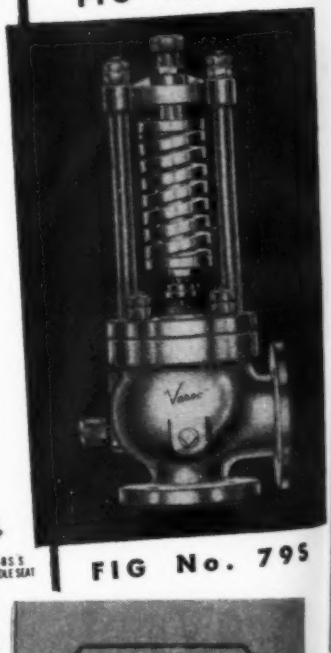


FIG No. 79S

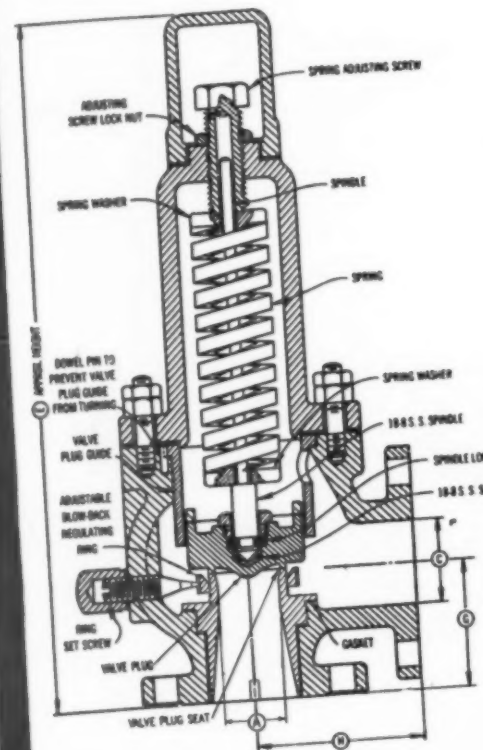


FIGURE No. 78

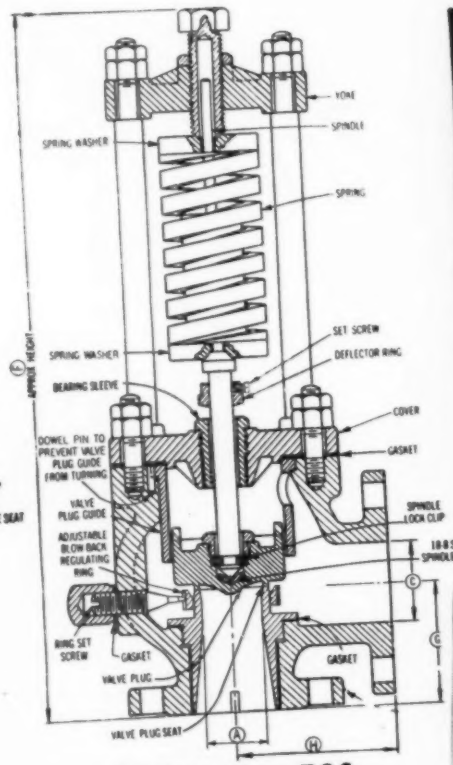
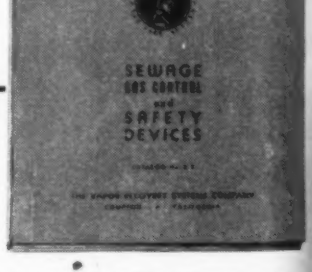


FIGURE No. 79S



The new "VAREC" Sewage Gas Control Handbook S-3 shows the complete line, as well as giving information and facts of value to sanitation engineers. Write for your copy today.

THE VAPOR RECOVERY SYSTEMS COMPANY
COMPTON, CALIFORNIA

NEW YORK CITY — CHICAGO, ILL. — HOUSTON, TEX. — TULSA, OKLA.

Agencies Everywhere—Cable Address VAREC-COMPTON (All Codes)

THE PACE SETTER SINCE 1928

CHEMICAL USERS' GUIDE To General Chemical Company Products for Treatment of Water, Sewage, and Industrial Wastes

PRODUCT	AVAILABLE FORMS	COMMERCIAL STRENGTH (MIN.)	SHIPPING CONTAINERS	APPLICATIONS
Aluminum Sulfate $Al_2(SO_4)_3 \cdot 14H_2O$ approx. *(Filter Alum)*	Commercial & Iron Free: Lump • Ground Powdered	17.25% Al_2O_3	Bags Barrels • Drums Bulk Carloads	Coagulant for water and sewage. Dewatering conditioner for sewage sludge. 1% Sol. pH 3.4.
Aqua Ammonia NH_4OH plus Water *(Ammonia Water)*	Colorless Liquid	26°Be. (29.4% NH_3)	Steel Drums Carboys	Used with chlorine to form chloramines for water and main disinfection.
Ammonium Aluminum Sulfate $Al_2(SO_4)_3 \cdot (NH_4)_2SO_4 \cdot 24H_2O$ *(Ammonia Alum) (Crystal Alum)*	Lump Nut Granular Powdered	11.2% Al_2O_3	Bags Fibre Drums	Coagulant for water. Advantageous for pressure filters. Supplies ammonia for chloramine formation. 1% Sol. pH 3.5.
Sodium Bisulfite, Anhydrous $Na_2S_2O_5$ *(ABS) (Sodium Metabisulfite)*	Powdered	97.5% $Na_2S_2O_5$ (Equiv. 65.5% SO_2)	Fibre Drums	Antichlor. Remove iron and manganese deposits from filter sand. 1% Sol. pH 4.6.
Sodium Silicate $Na_2O \cdot X(SiO_2)$ plus H_2O *(Water Glass) (Silicate of Soda)*	Viscous Liquid	38° to 52°Be. Various Ratios of $Na_2O \cdot SiO_2$	Drums Tank Cars Tank Trucks	1. Aid in floc formation. 2. Prevent red water in distribution lines. 1% Sol. pH 12.7.
Sodium Thiosulfate $Na_2S_2O_3 \cdot 5H_2O$ *(Hypo) (Sodium Hyposulfite)*	Crystals: Prismatic Rice Selected Universal Granular	99.75% $Na_2S_2O_3 \cdot 5H_2O$	Bags Barrels Fibre Drums	Antichlor. Water solution is neutral.
Sulfuric Acid H_2SO_4 plus H_2O *(Oil of Vitriol)*	Corrosive, oily liquid Various strengths	66°Be. (93.19% H_2SO_4)	Bottles Carboys Drums Tank Trucks Tank Cars	1. Reduce pH and alkalinity. 2. Regenerate carbaceous zeolites and ion exchangers.
Potassium Aluminum Sulfate $Al_2(SO_4)_3 \cdot K_2SO_4 \cdot 24H_2O$ *(Potash Alum)*	Lump Nut Granular Powdered	10.7% Al_2O_3	Bags Fibre Drums	Coagulant for water. Slow, even rate of solubility desirable for solution pots. 1% Sol. pH 3.52.
Sodium Sulfite, Anhydrous Na_2SO_3 *("Sulfite")*	Granular Powdered	98.5% Na_2SO_3	Bags Fibre Drums	Weak solutions absorb oxygen readily. 1% Sol. pH 9.8.
Sodium Sulfate, Crystal $Na_2SO_4 \cdot 10H_2O$ *(Glauber's Salt)*	Crystal & Needle Cryst.	96% $Na_2SO_4 \cdot 10H_2O$	Barrels Bags Drums	Neutral Solution.
Sodium Sulfate, Anhydrous Na_2SO_4	Powdered	99.5% Na_2SO_4	Bags Barrels	Neutral Solution.
Trisodium Phosphate $Na_3PO_4 \cdot 12H_2O$ *(TSP)*	Crystal	98.5—103% $Na_3PO_4 \cdot 12H_2O$ (Equiv. 19% P_2O_5)	Bags Barrels Fibre Drums	Boiler water treatment. Cleaning compound. 1% Sol. pH 11.8-12.0.
Disodium Phosphate, Crystal $Na_2HPO_4 \cdot 12H_2O$	Crystal	98% $Na_2HPO_4 \cdot 12H_2O$ (Equiv. 19.5% P_2O_5)	Bags Barrels Fibre Drums	Boiler water. (Calcium and magnesium precipitation.) 1% Sol. pH 8.4.
Disodium Phosphate, Anhydrous Na_2HPO_4	Powdered Flake	96% Na_2HPO_4 (Equiv. 48% P_2O_5)	Same	Same as Crystal, but stronger product.
Tetrasodium Pyrophosphate, Anhydrous $Na_4P_2O_7$ *(TSPP) (Pyro)*	Powdered	98% $Na_4P_2O_7$ (Equiv. 52% $5P_2O_5$)	Bags Barrels Fibre Drums	Stabilization of water.
Sodium Fluoride NaF *(Fluoride)*	Powdered (white or blue colored: Nile Blue) Light or dense	90% and 95% NaF	Bags Barrels Fibre Drums	Fluorination of water supplies. (For information, consult with local and state health officials.)

FOR THE LABORATORY: Baker & Adamson Laboratory Reagents

★ As a major source of Basic Chemicals for American Industry for almost half a century, General Chemical Company has long provided a wide range of products for use in the treatment of water, sewage, and industrial wastes. Pertinent data on such chemicals are compiled in this Chemical Users' Guide for your ready reference.

For full information, contact nearest General Chemical Sales & Technical Service office. Remember—when you make General Chemical your source of supply—these key chemicals so vital to your operations are always readily available from conveniently located plants and warehouses throughout the nation!

GENERAL CHEMICAL COMPANY
40 RECTOR STREET, NEW YORK 6, N. Y.

Sales and Technical Service Offices: Atlanta • Baltimore • Boston Bridgeport (Conn.) • Buffalo • Charlotte (N. C.) • Chicago • Cleveland Denver • Detroit • Houston • Kansas City • Los Angeles • Minneapolis New York • Philadelphia • Pittsburgh • Providence (R. I.) • San Francisco • Seattle • St. Louis • Utica • Wenatchee & Yakima (Wash.)

In Wisconsin: General Chemical Wisconsin Corporation, Milwaukee, Wis.

In Canada: The Nichols Chemical Company, Limited Montreal • Toronto • Vancouver

Worthington-Gamon WATCH DOG WATER METERS

The meter used by thousands of municipalities in the U. S. and abroad.

SURE TO MEET YOUR SPECIFICATIONS FOR ACCURACY, LOW MAINTENANCE, LONG LIFE

Before you invest in water meters, get acquainted with the design and performance advantages which make Worthington-Gamon Watch Dog Water Meters first choice of so many municipalities and private water companies in the United States.

WATCH DOG WATER METERS

"Watch Dog" models . . . made in standard capacities from 20 gpm up; frost-proof and split case in household sizes. Disc type, Turbine type or Compound type. Write for Bulletin.

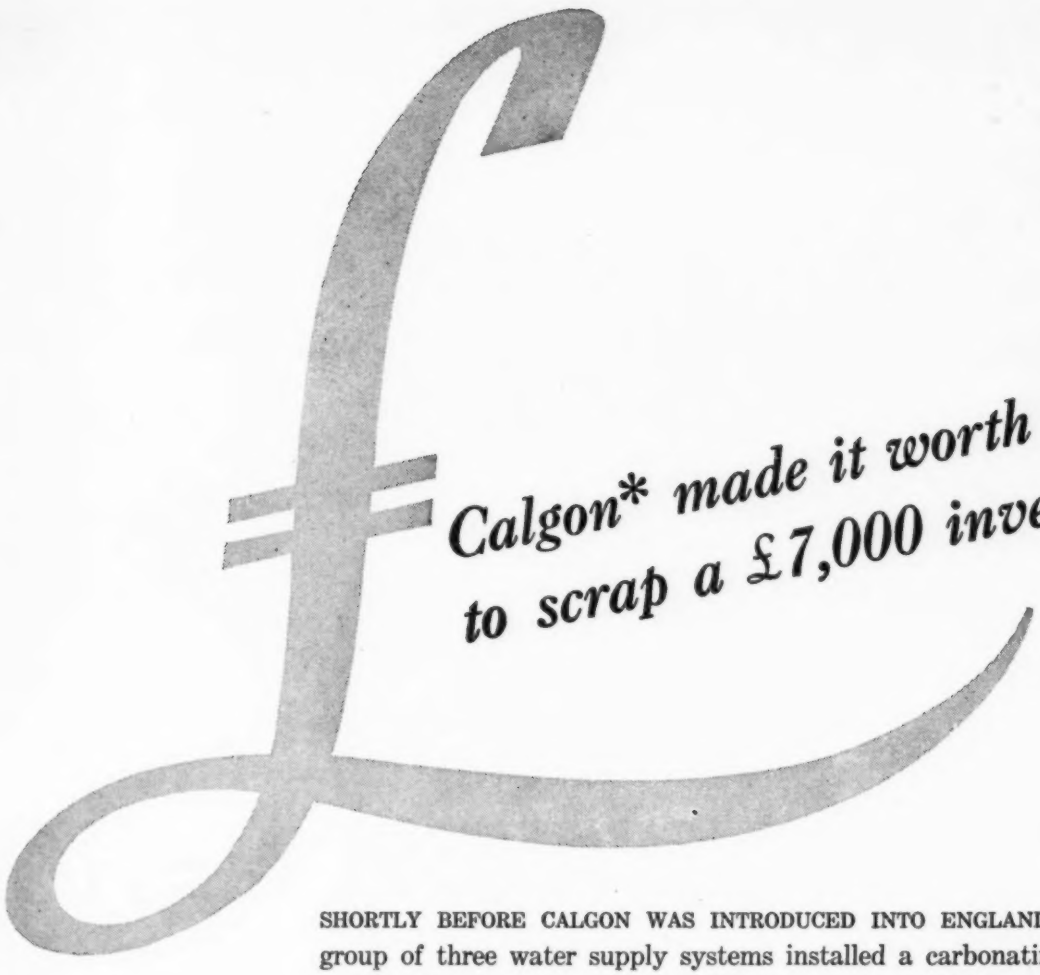
WORTHINGTON-GAMON METER COMPANY

296 South Street, Newark 5, New Jersey

Subsidiary of

WORTHINGTON

PUMP AND MACHINERY CORPORATION



£ Calgon* made it worth while to scrap a £7,000 investment

SHORTLY BEFORE CALGON WAS INTRODUCED INTO ENGLAND, one of a group of three water supply systems installed a carbonating plant to stabilize the lime-softened water. This plant cost £7,000—approximately $28,000.

Two years later stabilization of water at a second plant was decided on. Estimated cost of the carbonating equipment was £15,000.

By this time, however, the engineers were familiar with Calgon. The £15,000 plant was discarded in favor of Calgon feeding equipment which cost approximately £150.

Four months after commencement of Calgon treatment in the second plant, the first plant also turned to Calgon. *Results and costs of Threshold treatment with Calgon made it more profitable to scrap that £7,000 investment than to continue to use the CO_2 method of stabilization.*

A year later, a third plant in the system started the use of Calgon. That was four years ago—and all three have continued to use Calgon ever since.

Men in charge of water supply systems are sometimes reluctant to write off investments in equipment which is still in good physical condition. This reluctance is understandable—but, as American industry knows, it is an expensive economy to continue the use of a less efficient method when a better method is available.

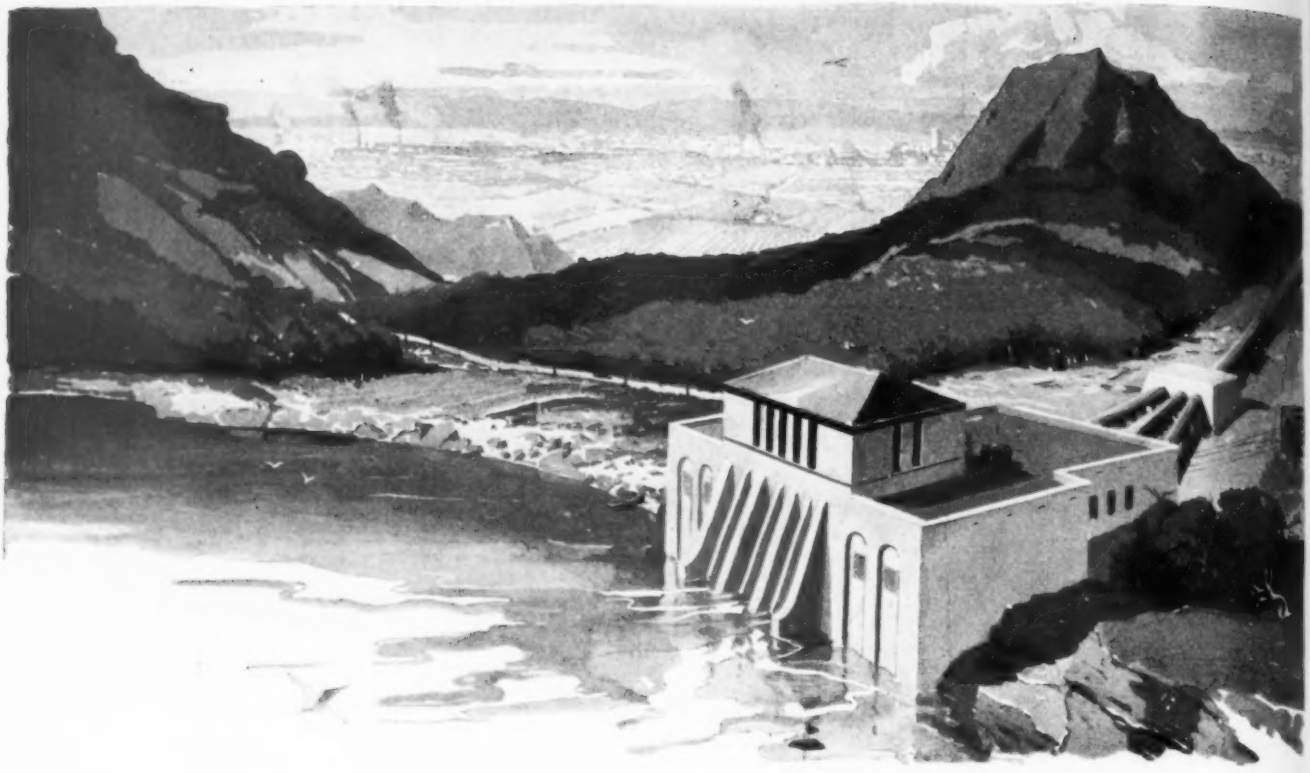
** T. M. Reg. U. S. Pat. Off.*

HAGAN HALL BUROMIN CALGON

calgon, inc.

A SUBSIDIARY OF HAGAN CORPORATION

HAGAN BUILDING PITTSBURGH 30, PA.



WHEN Millions Live As One

ADVENTURESOME folk, since the beginning of time, have migrated . . . Settling in tiny clusters . . . Spreading spider-web fashion to dot the land with villages and towns . . . While others pressed forward, facing dangers concealed behind each rock and tree!

But with the growth of cities, new perils arose and multiplied . . . People were living too closely together . . . Epidemics and pestilence exacted their toll . . .

Then science and modern machinery rescued them from exposure to disease emanating from impure water and unsanitary waste disposal . . . And, today, *millions live as one!*

Rotovalves and Axial Flow Pumps, by Smith, are in service—controlling water, controlling floods and regulating sewage discharge, in important systems, far and wide.

The recognition and acceptance given these products are not accidental. They come from superior design, resulting from our more than 70 years of hydraulic experience . . . Facts that are significant, because they are proof positive of our ability to serve you, *if you place your problem in our hands!*

S·MORGAN SMITH COMPANY
YORK·PENNSYLVANIA~U·S·A·
If It's Hydraulics-Put It Up to Us·

POWER by SMITH

When you stop to think of all the punishing service conditions that an outfall line must face, it points up the importance of careful material selection.

The line is exposed to severe corrosion, from sewage within, and salt water without. Shifting sands may leave long sections unsupported, and in addition introduce an abrasive action. Currents and tides often create stress and shock.

Wrought iron offers a combination of service qualities that have proved unusually effective in combatting these conditions, as the records of old installations show. In one California installation, wrought iron was still serving after 50 years. In another, a 30-year wrought iron line was still doing its job. A New Jersey line, installed in 1912, was examined 20 years later when an addition was required. It was in such excellent shape that the engineers immediately selected wrought iron for the new line. These are only a few of many examples, but will serve to indicate the splendid performance of wrought iron.

It is no accident and no mystery that wrought iron serves so well. The tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, act like baffles, to halt and diffuse corrosive attack. They also anchor the initial protective scale, which shields the underlying metal. Further, this combination of fibers and iron gives a structure something like that of a stranded wire cable, which adds resistance to stress and shock.

You will find some helpful, factual information on wrought iron for outfall lines in our bulletin, "Wrought Iron for Sewage Treatment and Disposal Installations." We will be very glad to send you a complimentary copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco, Atlanta.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

TAKE A LOOK INSIDE...

for another Transite Sewer Pipe economy

ONE LOOK at the smooth interior surface of Transite Sewer Pipe (n=.010) tells you "Here's a pipe with high-flow capacity!" This often permits flatter grades, with lower trenching costs—especially important in rock excavation or wet trenches. Other far-reaching economies:

Use of smaller pipe—Instead of using flatter grades, designers sometimes take advantage of Transite's high-flow capacity to use smaller diameter pipe.

Lower handling costs—Transite's long 13-foot lengths and light weight mean more pipe per truckload . . . fewer joints to assemble . . . fewer man-hours to lay to line and grade.

Reduced treatment costs—Transite joints, combining tightness with flexibility, guard against infiltration . . . reducing load at disposal plant, helping keep treatment costs low.

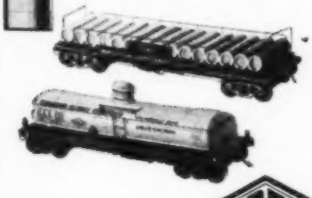
Smaller treatment plants—Possible because Transite minimizes infiltration. Where new plants are being designed, substantial savings in initial cost may be effected.

Further details on Transite Sewer Pipe for gravity lines are given in brochure TR 21-A; on Transite Pressure Pipe for force mains and water lines, in brochure TR 11-A. Write Johns-Manville, Box 290, New York 16, N. Y.

JM

Johns-Manville TRANSITE SEWER PIPE

Protection Plus



The assured protection you get when you buy Diamond Liquid Chlorine comes from the dependable uniformity of this high quality product. Protection—plus confidence in *continued* protection—is yours when you specify DIAMOND LIQUID CHLORINE.

Shipments are made in cylinders, multi-unit cars, or tank cars, according to your requirements.

CHLORINE

DIAMOND ALKALI COMPANY

PITTSBURGH, PA., *and Everywhere*

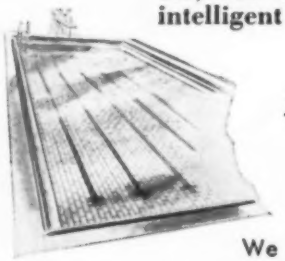
DIAMOND LIQUID CHLORINE

MODERNIZE YOUR ZEOLITE WATER SOFTENERS

☑ Save Money
☑ Save Labor

The new Belcolite zeolite will increase the capacity of industrial water softeners in many instances up to 6 times as much. It is ideally suited for modernization of present equipment. Belco engineers will be glad to make recommendations for new water perfection equipment or submit proposals for your new or replacement requirements.

Whether your particular problem is Filtration, Softening, Silica Removal or Production of Distilled Water for high pressure boilers, our engineering department is ready to help you with an intelligent solution.



FOR LATEST IN SWIMMING POOL PURIFICATION SYSTEMS CALL BELCO

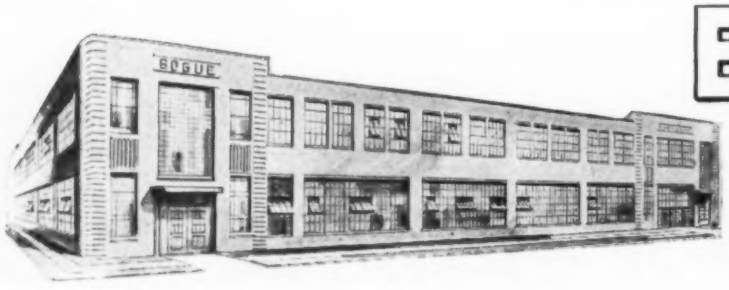
We cooperate with architects and engineers in supplying modern equipment. Our interesting booklet of air views is available to you on request.

BELCO INDUSTRIAL EQUIPMENT DIVISION

Industrial Processing Equipment Since 1892

300 IOWA AVENUE — PATERSON 3, NEW JERSEY

Belco



In BOTH water supply and sewage Beckman pH control

Cuts treating costs... Saves chemicals... Increases efficiency

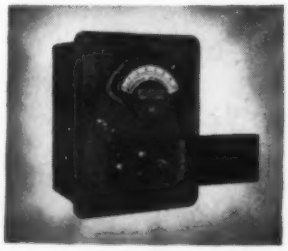
...IN WATER SUPPLY

In the main treating plant of the giant Metropolitan Water District of Southern California—a system capable of delivering a BILLION gallons of water per day across the entire state of California, and one of the largest water treating jobs in the world—the pH control equipment is 100% BECKMAN! In the mammoth treating plant where the water is softened and purified, Beckman Automatic pH Instruments control the pH of the liming process... of the carbonation process... and the pH of the final treated water. This 100% installation is notable tribute to the dependability of Beckman Equipment!

...IN SEWAGE TREATMENT

At its Stickney installation—world's largest sewage plant—the Sanitary District of Chicago tried Beckman pH Control on the chemical end of its sewage treating operations ...found that it not only saved time and chemicals, but increased plant efficiency and decreased operating costs so successfully that a second installation was ordered for its Calumet Plant to cut operating costs there. Recently it ordered a THIRD Beckman pH Installation for still another plant in its large municipal system. Clear-cut evidence like that tells its own story!

LARGE OR SMALL, *YOUR* PLANT CAN SAVE WITH BECKMAN pH CONTROL!



The Beckman Automatic pH Indicator—Continuously and automatically *indicates* pH, and operates standard *recording* and *control* equipment for fully automatic pH control. Ask for Bulletin 161

The Beckman Industrial pH Meter—Ideal for portable plant and field use. Simple, rugged, accurate, and incorporates many unique operating features. Write for Bulletin 211

FREE! WHAT *EVERY* EXECUTIVE SHOULD KNOW ABOUT pH... simplifies the technicalities of modern pH control. Tells what is it, how it's used, where it fits into modern treating operations. Send for your free copy today!

Name_____

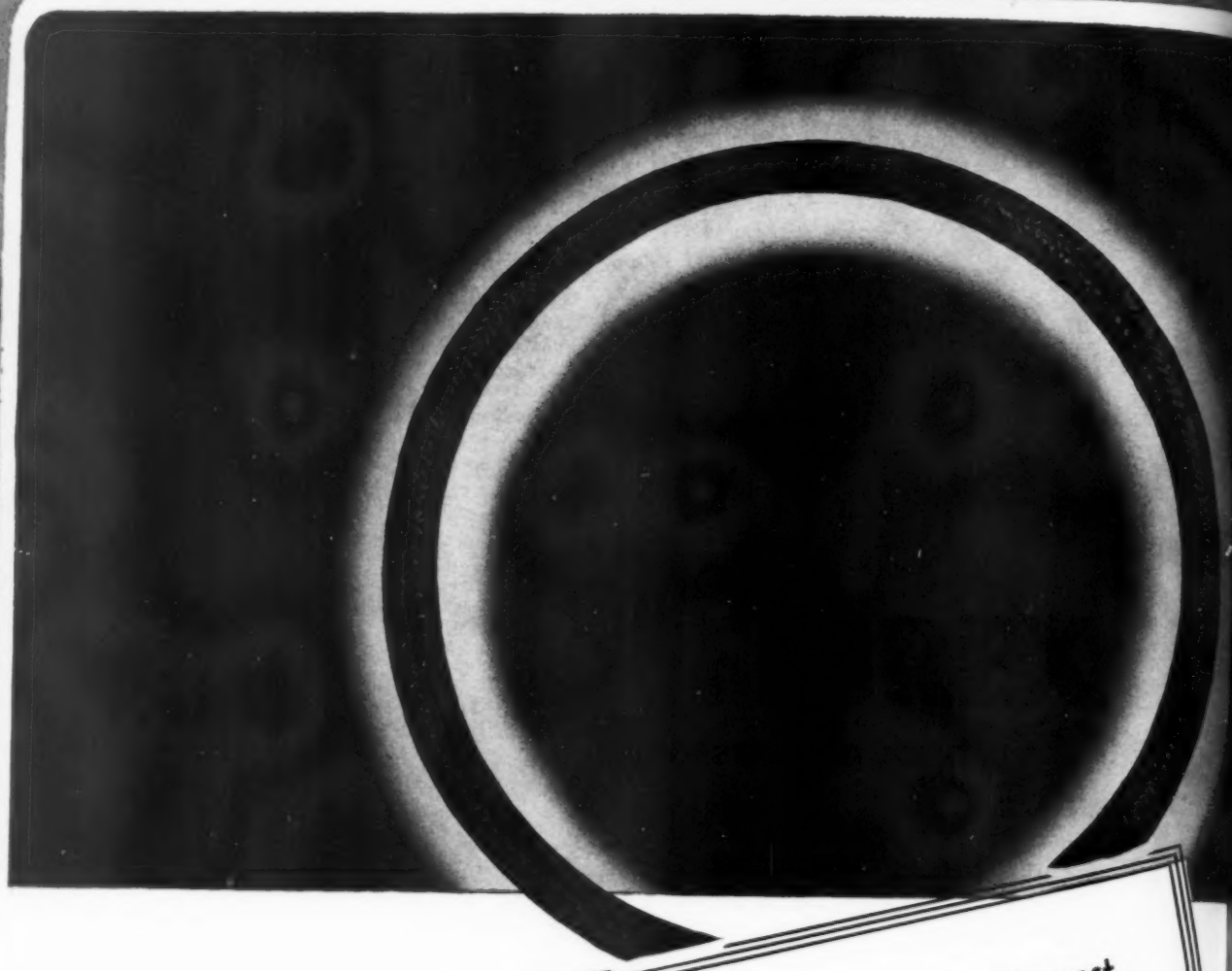
Position_____

Address_____

City_____ State_____

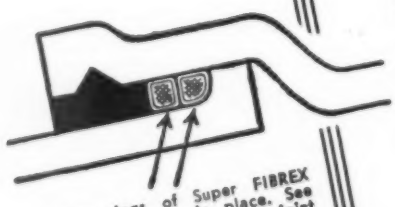
NATIONAL TECHNICAL LABORATORIES
SOUTH PASADENA CALIFORNIA

Beckman THE LEADING NAME IN pH



Super-FIBREX is the very last word in packing for cast iron bell and spigot joints. A clean, sleek rubber jacket has been added to bacteria-free FIBREX to make it the most sanitary packing ever produced.

Super-FIBREX comes ready to use—cut to exact pipe size. It packs into the joint perfectly, conforming to the pipe contours, making a tight bond—rubber to metal. Used with HYDRO-TITE it makes the finest joint ever developed for bell and spigot water mains.



Two rings of Super FIBREX tamped firmly in place. See how they conform to joint space, making perfect bacteria-free seal.

Now

HYDRO-TITE

Joints Will Be Better

Than Ever Before

Hundreds of water works men can attest to the fact that HYDRO-TITE has joined thousands of miles of cast iron pipe with complete satisfaction. Now, by using *Super*-FIBREX an even better joint results. *Super*-FIBREX, when properly tamped in, takes the shape of the pipe end and makes a permanent rubber-clad gasket. Due to the construction of *Super*-FIBREX there are no open or weak spots. It makes a complete seal—rubber to metal.

Use *Super*-FIBREX—with time-tested HYDRO-TITE for permanently tight bell and spigot joints.

A PIPE LINE
IS NO BETTER
THAN ITS JOINTS

HYDRO-TITE

A DEPENDABLE SELF-CAULKING JOINTING COMPOUND

Super FIBREX plus

A BACTERIA-FREE RUBBER-COVERED, USED LIKE BRAIDED JUTE

CUT TO EXACT SIZE
PACKAGED
READY TO USE

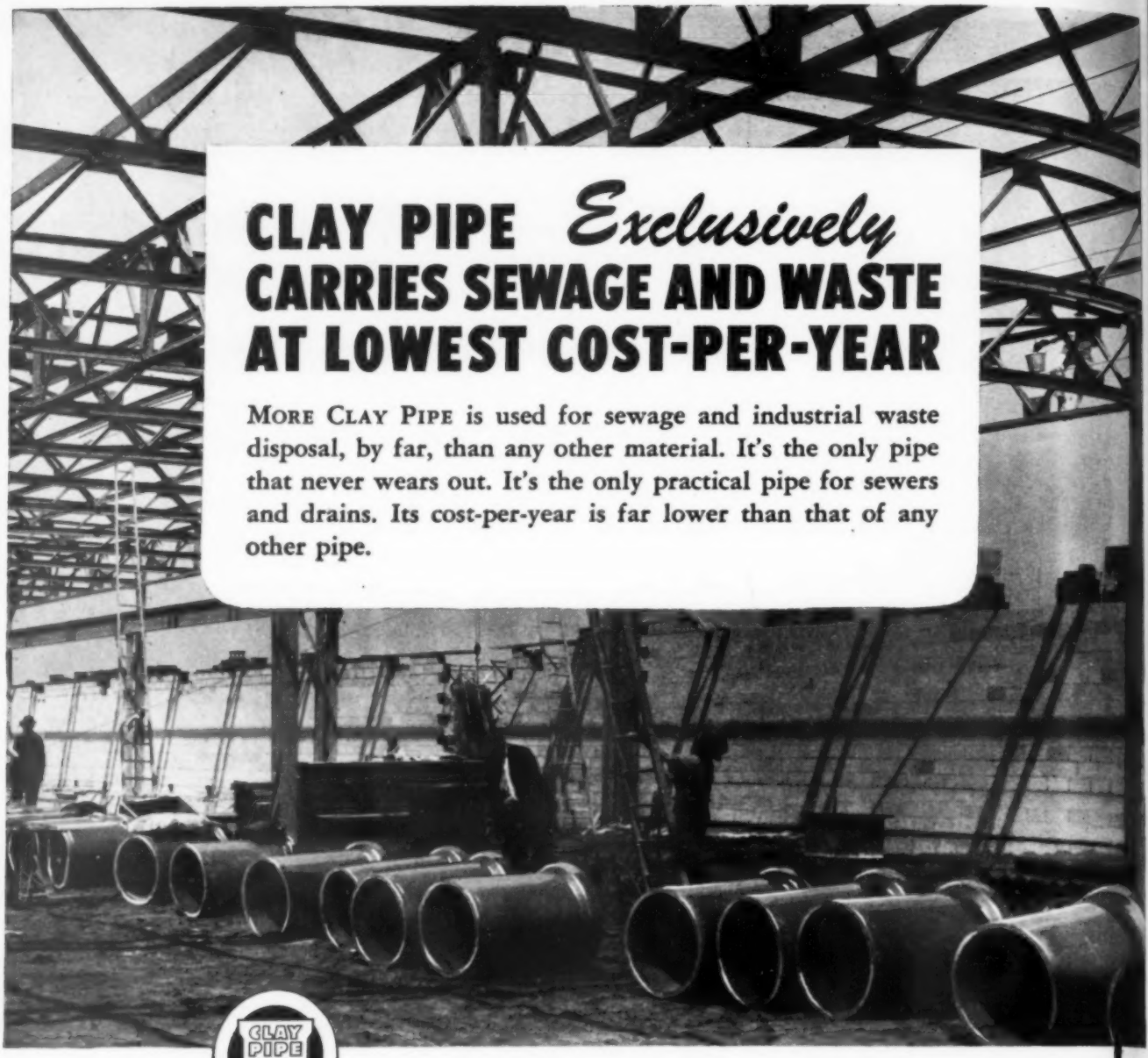
Conveniently packaged in exact pipe-circumference, ready-cut lengths. No waste of time or material. Available in all pipe sizes. Send for sample.

SAMPLE ON REQUEST

HYDRAULIC DEVELOPMENT CORPORATION

Main Sales Office: 50 Church Street, New York, N. Y.

General Office and Works: West Medford Station, Boston, Mass.



CLAY PIPE *Exclusively* CARRIES SEWAGE AND WASTE AT LOWEST COST-PER-YEAR

MORE CLAY PIPE is used for sewage and industrial waste disposal, by far, than any other material. It's the only pipe that never wears out. It's the only practical pipe for sewers and drains. Its cost-per-year is far lower than that of any other pipe.

CLAY PIPE NEVER WEARS OUT!

Because Clay Pipe is made of nature's indestructible material, *clay,* processed by vitrification to have everlasting qualities, it is chemically inert . . . eliminating corrosion, decomposition and rust. It can be depended on to carry sewage safely year after year. You can count on it to eliminate idle production time brought about by failures in waste disposal lines. Clay Pipe is the time-proved pipe engineers, architects and builders know can be trusted for the big, tough jobs as well as the smaller ones.

For information or engineering literature from one of the regional association offices, write to:

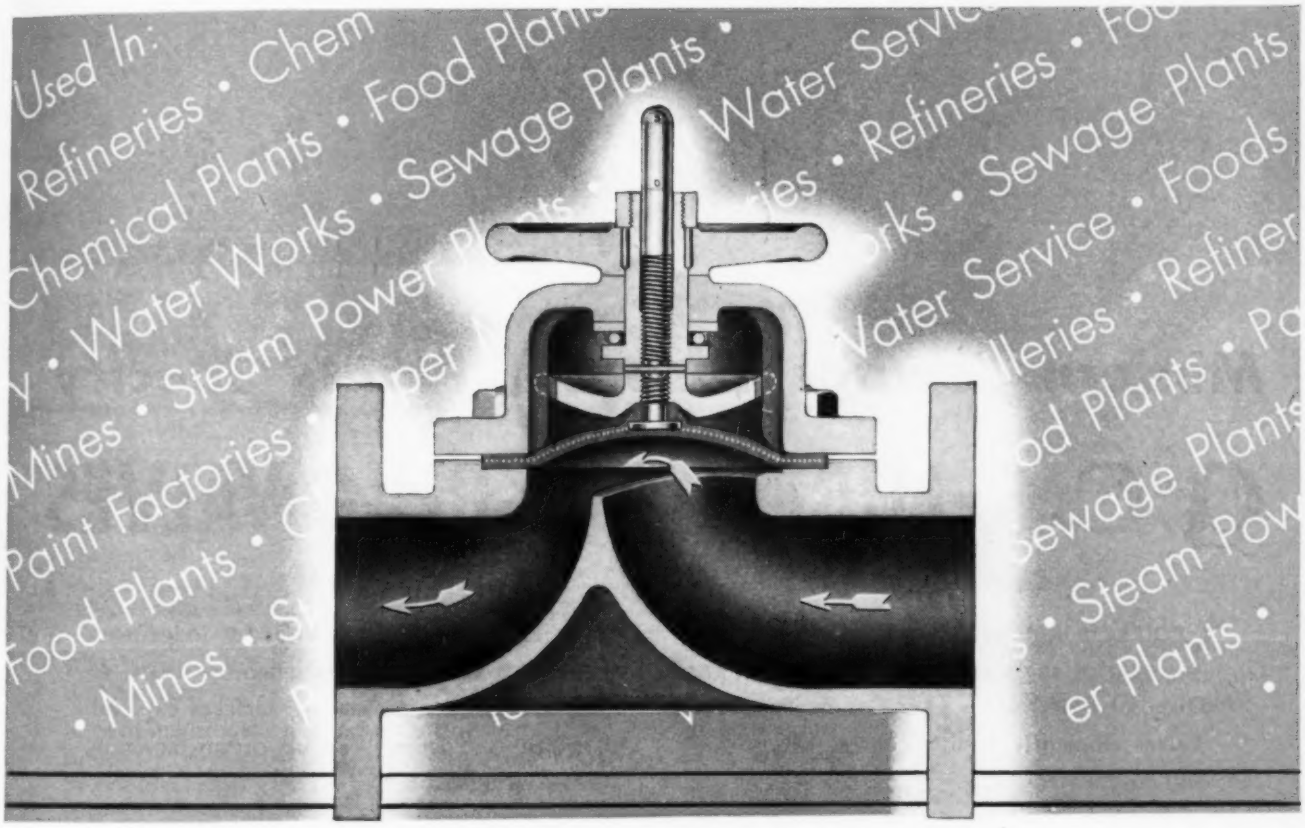
NATIONAL CLAY PIPE MANUFACTURERS, Inc.
571 Chamber of Commerce Building, Los Angeles 15, Calif.
522 First National Bank Building, Atlanta 3, Georgia
1105 Huntington Bank Building, Columbus 15, Ohio
111 West Washington Street, Chicago 2, Illinois

C-646-3D

CLAY PIPE

NOW...A VALVE THAT LAUGHS AT CORROSIVES AND ABRASIVES

...and cannot LEAK, "FREEZE" or JAM!



McAlear No. M-1455 Diaphragm Valve

★ *Pressures, Vacuum to 150 lbs.* ★ *Temperatures to 150° F.* ★ *Sizes ½" to 6".*

- Applicable for air and water lines and special services.
- Used in *every* industry that handles corrosive or abrasive fluids.
- Diaphragm separates mechanism *completely* from fluids handled.
- Shut-off positive—even with solids trapped on seat.
- Closure not dependent on metal-to-metal contact.
- Cannot leak in any position.
- Requires no re-packing.
- Requires no re-seating.
- Diaphragm replaceable with valve in line.
- Special pressure operated types for automatic or pilot control.

FOR BULLETIN giving complete data, write McAlear Manufacturing Company, Automatic Control Division of Climax Industries, 1949 S. Western Ave., Chicago 8, Illinois.

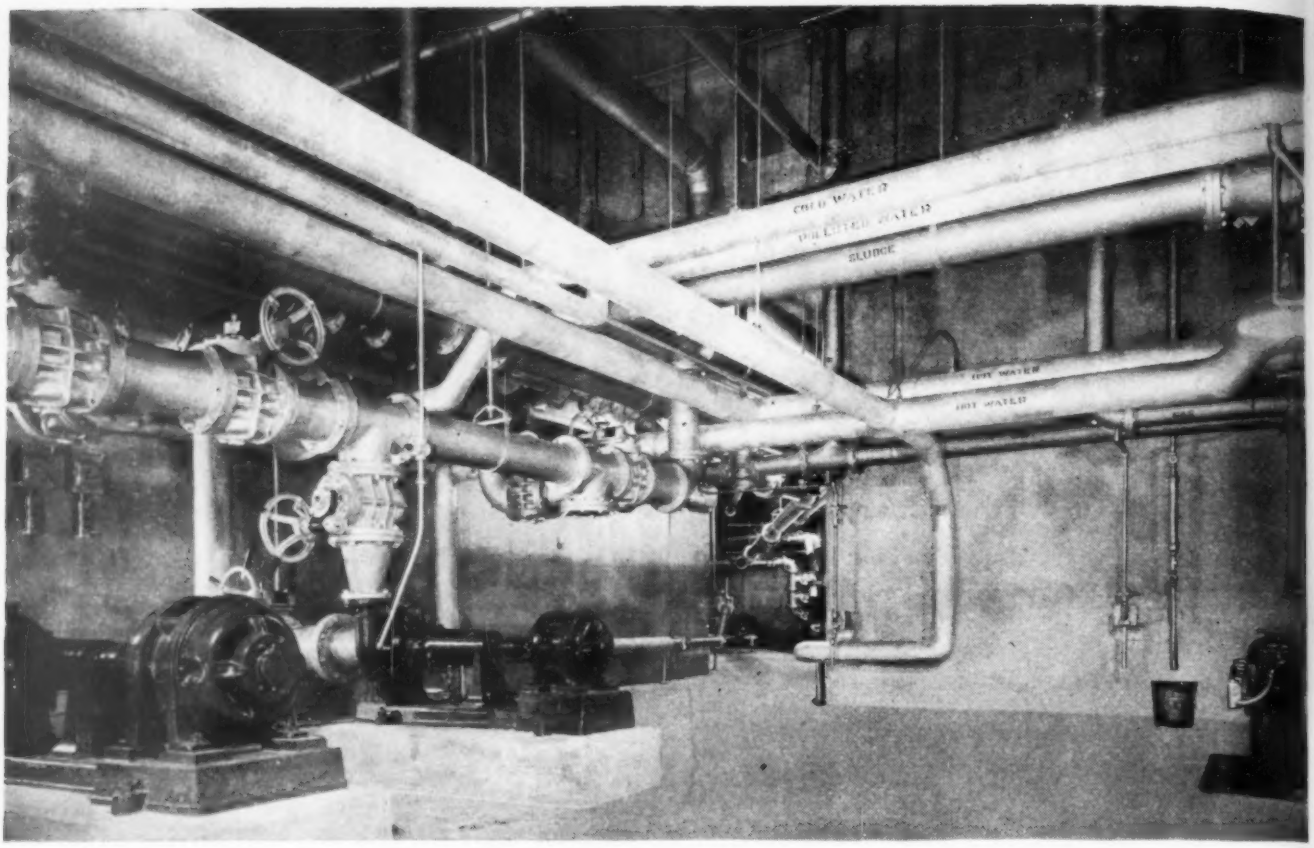
CLIMAX INDUSTRIES

McALEAR

PRESSURE · FLOW · LIQUID LEVEL · TEMPERATURE

controls

for STEAM, WATER, AIR, OIL—GAS



Modern Sewage Disposal Plants Specify

a.c.f. LUBRICATED PLUG VALVES

YOU'RE looking at the modern, efficient pump room of the Fort Wayne, Indiana Sewage Disposal Plant. Here a.c.f. Lubricated Plug Valves efficiently handle sludge, air, gas, hot and cold water.

As in Fort Wayne many of our foremost Sewage Engineers are finding that plug valves are the ideal insurance against stoppages in sewage disposal plants. Full-pipe area of a.c.f. Lubricated Plug Valves does not restrict the flow of lading. Straight-through passage means there is no change in direction to interrupt the flow ...no turbulence to cause friction loss of head pressure. There are no recesses for lodgement of solids from lading. Even when open a.c.f. Plug Valves have no seating surfaces exposed to the wear of lading—an important factor in extending valve life.

Modernize your sewage disposal plant with the most efficient, up-to-date valve installations. There is no need to disrupt present equipment as we can supply a.c.f. Lubricated Plug Valves with the same face-to-face dimensions as existing gate valves. For complete specifications and details of all types and sizes write for catalogue 3-W.

a.c.f.

AMERICAN CAR AND FOUNDRY COMPANY
Valve Department
30 CHURCH ST., NEW YORK 8, N. Y.

Wilson PULSAFEEDER

UP TO 500,000 GALLONS DAILY

For water systems for which peak demand does not exceed 500,000 gallons per day, the Pulsafeeder type of hypochlorinator is more economical and more satisfactory than gas chlorination.

CONTINUOUSLY ADJUSTABLE WHILE IN OPERATION

Rate of feeding with Wilson Pulsafeeders is continuously adjustable, from zero to maximum flow, by simple turning of a micrometer knob on the side of the machine, while Pulsafeeder is in operation. Meter-controlled model is actuated by water meter, provides exactly proportioned feeding at all rates of flow.

HYDRAULICALLY-BALANCED DIAPHRAGM HEAD

Exclusive Pulsafeeder construction is an hydraulically-balanced diaphragm which isolates the piston and cylinder from the chemical solution being pumped. No packing glands required. No corrosive attack on pump parts by chemical solutions.

MULTIPLE-HEAD PULSAFEEDERS

Pulsafeeders are available in models with one, two, three or four heads, all driven by the same motor. Solutions for hypochlorination, ammoniation, algae control, pH control, color, odor or taste control may be fed in any combination, in exactly proportioned rates.

SEALED-IN LUBRICATION

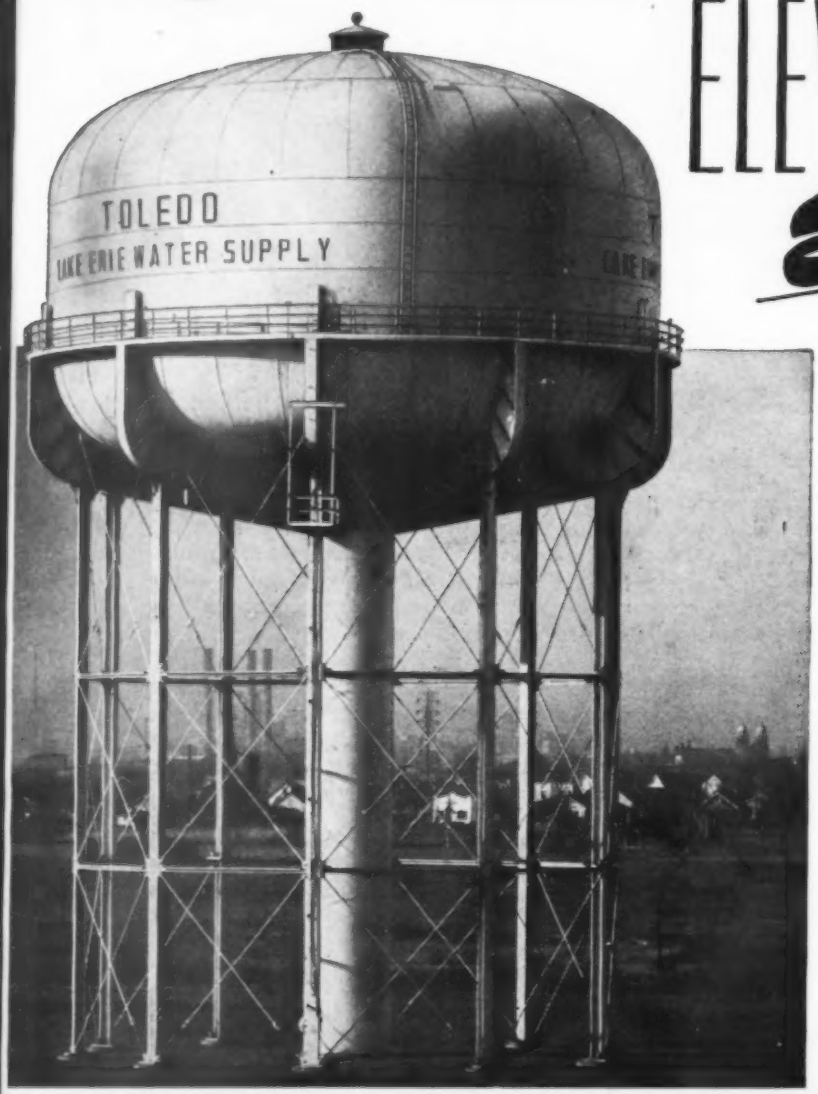
All working parts of the Pulsafeeder—except the motor—are enclosed in a housing and run in an oil bath. Minimum maintenance required, long life assured.

Illustrated literature and specifications—also data sheet for factory recommendations on *your* requirements—available on request. *Process Equipment Division, Lapp Insulator Co., Inc., 119 Maple St., LeRoy, N. Y.*

Lapp

PITTSBURGH • DES MOINES

ELEVATED STEEL TANKS



ASSURE IMPROVED WATER SERVICE FOR EVERY COMMUNITY NEED!

Fundamental to modern municipal progress is better water service for the consumer—expressed in the desirable forms of constant supply, uniform pressures around the clock, dependable fire protection, ample reserves for emergencies. Elevated water storage in Pittsburgh-Des Moines Steel Tanks provides these benefits at low cost—originally, and during their many years of useful life. Write for the complete story of Modern Water Storage in our illustrated new brochure: we'll send your copy promptly!

PITTSBURGH • DES MOINES STEEL CO.

PITTSBURGH, PA., 3412 NEVILLE ISLAND—DES MOINES, IOWA, 913 TUTTLE STREET
NEW YORK, ROOM 915, 270 BROADWAY • CHICAGO, 1216 FIRST NATIONAL BANK BUILDING
DALLAS, 1217 PRAETORIAN BUILDING • SAN FRANCISCO, 619 RIALTO BUILDING
SEATTLE, 520 FIRST AVENUE, SOUTH

..IN WORLD'S LARGEST FILTRATION PLANT

Complete Flow Measurement and Flow Control by

BUILDERS-PROVIDENCE

Now, another great plant, the South District Filtration Plant of the City of Chicago, is added to the impressive list of water and sewage works served by Builders Equipment. Such continuing recognition through the years in plants, large and small, is an eloquent tribute to Builders Equipment. To those charged with planning of new works or rehabilitation of existing plants, this wide approval of Builders among engineers, superintendents and operators is highly significant.

• • •

For Bulletins on Builders Equipment address Builders - Providence, Inc., (Division of Builders Iron Foundry), 10 Codding St., Providence 1, R. I.

BUILDERS PRODUCTS

VENTURI, PROPELOFLO AND ORIFICE METERS • TYPE M AND FLO-WATCH INSTRUMENTS • VENTURI FILTER CONTROLLERS AND GAUGES • MASTER CONTROLLERS • KENNISON NOZZLES • CHRONOFLO TELEMETERS • CONVEYOR SCALES

BUILDERS BUILDERS Instruments **PROVIDENCE**

Builders Equipment at South District Filtration Plant, Chicago.

Complete Venturi Metering of all Water Pumped
80 Venturi Filter Effluent Controllers
80 Loss of Head, Rate of Flow & Sand Expansion Gauges
Master Rate Control
Master Rate Summation

BIG HELP . . .

In Bell and Spigot Main Jointing

This simple, wedge-shaped rubber device helps in these important ways

✓ Prevents Recontamination

Rubber cannot harbor bacteria nor support their growth internally where water main sterilizing agents cannot reach. Use of Hyde-Ro Ring prevents continued recontamination, so often traced to joint packing.

✓ Makes Repeated Hypochlorite Flushings Unnecessary

Your first hypochlorite flushing will invariably secure negative reaction.

✓ Saves Water Waste

With tight seal more quickly secured, water waste is cut 'way down.

✓ Facilitates Repairs

Caulked tightly into place, the Hyde-Ro Ring dams off water from leaking valves and permits pouring of dry joints.

✓ Saves Its Cost Over and Over

The cost of HYDE-RO Rings is insignificant compared to that of repeated hypochlorite treatments, or the expense of sterilizing and keeping sterile *(if it can be done)* other types of packing.

EASILY INSTALLED

No measuring or cutting. You can't use the wrong size. Being solid, ring has no laps to take up joint space. Same ring fits straight or beaded end pipe. Your narrow caulking iron slips automatically into groove in back. Conveniently packaged—cartons of fifty rings; compact, light in weight; easily handled and stored.

Sizes available for 4, 6, 8, 10 and 12" cast iron pipe. Works with *Tegul*-MINERALEAD, Portland Cement or lead. For further information, write us at Mertztown.

THE *Atlas Mineral*

YOU'LL ALSO WANT A GOOD JOINTING COMPOUND

You'll get • Reduced initial leakage • Ease of handling and working • No trouble from premature wetting • Tight joints of *much* higher resistance to mechanical and thermal shock . . . and other advantages in

Tegul-MINERALEAD — *The Ingot Form Compound*

Contact an Atlas representative at branch office nearest you.

PRODUCTS COMPANY OF PENNA.

MERTZTOWN, PENNSYLVANIA

*ATLANTA 3, Ga., 452 Spring St., N. W.
*CHICAGO 1, Ill., 333 N. Michigan Ave.
*DALLAS 5, Tex., 3921 Purdue St.
*DETROIT 2, Mich., 2970 W. Grand Blvd.
*KANSAS CITY 2, Kan., 1913 Tauromee Ave.
NEW YORK 16, N. Y., 280 Madison Ave.
PITTSBURGH 10, Pa., 4656 Old Boston Rd.
ST. LOUIS 8, Mo., 4485 Olive St.

THE ATLAS MINERAL PRODUCTS COMPANY OF TEXAS, Inc., Box 1023, Houston 1, Texas

*DENVER 2, Colo., 1921 Blake St.
*LOS ANGELES 12, Calif., 172 S. Central Ave.
*SALT LAKE CITY 11, Utah, 1212 S. State St.
SAN FRANCISCO 7, Calif., H. G. Roberts, 115 Townsend St.
*SEATTLE 4, Wash., E. N. Hallgren Co. 1252 First Avenue, S.
*HONOLULU 2, Hawaii, U. S. A., Lewers & Cooke, Ltd., P. O. Box 2930
IN CANADA: H. L. Blachford, Ltd., 977 Aqueduct St., Montreal, P. Q.
*Stocks carried at these points

WATER & SEWAGE WORKS

L. H. ENSLOW, Editor
155 East 44th Street, New York 17, N. Y.

E. S. GILLETTE, Publisher
330 South Wells Street, Chicago 6, Ill.

COMING!

"Hydraulics for the Practical Water Works Man"

At long last we are so fortunate as to secure an able teacher to develop a series of articles which will discuss "Hydraulics" in readily understandable terms for the benefit of the practical water works operator and others who have never had the benefit of a college course in the science of hydraulics. As the author states in his introductory article, it is to be his aim to lay down in the simplest form the basic principles underlying the flow and behavior of water and sewage, and will show their application in a number of practical problems. Those who have heard this distinguished teacher lecture, or have read his published articles, will be eagerly looking forward to "Hydraulics for the Practical Water Works Man," by—

ROBERT W. ANGUS, M.E.*
(Professor Emeritus, Univ. of Toronto)
Consulting Engineer, Toronto.
*Honorary Member, A.W.W.A.

"Mapping Fields of Sewage Contamination"

Reveals the methods developed and employed by the Los Angeles County Sanitation District for determining and mapping the extent and degree of contamination of the waters above and adjacent to the outlet of an ocean outfall sewer. This interesting story comes from—

A. M. RAWN* and H. K. PALMER,
Chief and Asst. Engineer, Los Angeles County San. Distr.
(*Editorial Associate, Water & Sewage Works.)

"Manganese Removal by Heavy Chlorination"

Recites the recent experiences of Baltimore, Md., in solving a manganese removal problem through the use of raw-water chlorination in excess of the well known breakpoint, resulting in complete removal of the manganese by oxidation of organic complexes as well as the manganese. Cost data provides added interest in that it reveals that the super-chlorination process resulted in overall savings in comparison with methods previously employed, wherein the manganese had been removed by coagulation with iron salts at high pH values. The authors are—

S. E. EDWARDS and G. B. McCALL,
Bureau of Water Supply, Baltimore, Md.

"Sludge Lagoons"

May not only meet emergencies which arise, but in some locations may even be the whole solution to sludge disposal problems. But, lagoons must be carefully supervised and operated with common sense. Advice on construction and operation of sludge lagoons is given by an ex-plant superintendent of long experience—

DON E. BLOODGOOD,
Assoc. Prof. of San. Engr., Purdue University.

"The Water Supply Situation in Frankfurt, Germany"

Constitutes an interesting disclosure of the design and operation of the water supply facilities of Frankfurt, Germany, and what happened to the system as the result of the heavy bombings which this city received from American bombers. The author served in an Engineer Combat Battalion up to May 1945, transferring to Military Government duty as Trade and Industry Officer. He is—

KENNETH S. WATSON, Chemical Engineer,
State Water Commission, Charleston, W. Va.

"Bio-Filter Operation at Keesler Field, Miss."

Is a comprehensive survey of two years' operating results by the former engineer in charge of that plant. The accumulation and publication of such data on bio-filter operation are offered as a benefit to future design according to the author—

R. W. SIMPSON, San. Engr.,
Gilbert Associates, Inc., Reading, Pa.

VOL. 93, No. 6 — CONTENTS — JUNE, 1946

Construction Costs and Water Rates 205
By Louis R. Howson
Chicago, Illinois

A.W.W.A. Holds Most Successful Convention of All Time .. 211

Screen Clogging by a Rare Species of Algae 223
By W. W. DeBerard and John R. Baylis
Chicago, Illinois

A New Concept of Coagulation 225
By Harold R. Hay
Philadelphia Quartz Co.

Thirty-Eighth Annual Meeting of Indiana Section A.W.W.A. 227

A Condensed Operating Record 232
By Wendell R. LaDue
Akron, Ohio

Survey of Elementary Mathematics, Part II 233
By Warren K. Eglof
Niagara University, N. Y.

A New Method of Heating Sludge Digesters 236
By C. E. Keefer
Baltimore, Maryland

Water and Sewage Patents 239

Sludge Index Control by Chlorination 240
By J. Kenneth Adams
Tenafly, N. J.

The Magnetic Drive 243
By C. W. Camp
Harrison, N. J.

Odor Control and Control of Filter Flies 247
By A. A. Hirsch
Baton Rouge, La.

Why High Rate Filters Work 251
By John R. Downes
Plainfield, N. J.

Weather Cycles and Their Causes 252
By Halbert P. Gillette
The Gillette Publishing Co.

Meetings Scheduled .....Ad. Page 106

Here and There with "Doc" Symons .....Ad. Page 110

Manufacturers' and Equipment News .....Ad. Page 114

Literature and Catalog Reviews .....Ad. Page 129

Associate Editor
GEORGE E. SYMONS, Ph.D.

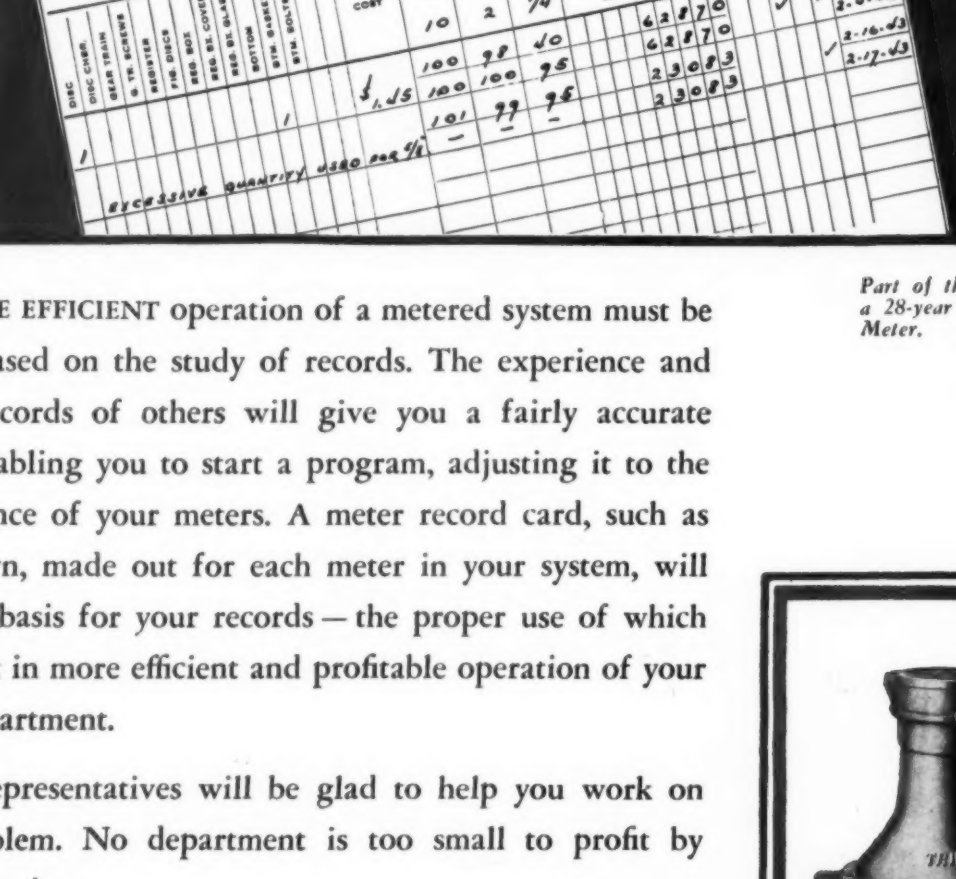
Editorial Associates	Adv. Editor
J. R. BAYLIS	H. J. CONWAY
A. M. RAWN	Make-Up Editor
H. A. FABER	L. D. SANDERS

OFFICE OF PUBLICATION
330 South Wells Street, Chicago 6, Ill.

H. P. GILLETTE, Pres.; E. S. GILLETTE, Vice Pres.; L. H. ENSLOW, Vice Pres.
New York Office... J. M. Angell, Jr., Mgr., 155 East 44th Street
Chicago Office..... L. H. Lingnor, Rep., 330 S. Wells Street
Cleveland Office... Lee B. McMahon, Mgr., Leader Building
Los Angeles Office. Don Harway, Rep., 816 W. Fifth Street

WATER & SEWAGE WORKS is a monthly publication. Single Copies, 25 Cents: Subscription Rates, U. S. and Canada, $2 per year; Foreign, $3

THE TIME IS HERE...



WATER METER DIVISION

Address 1712 CENTRAL ST. Account No. 8691
Meter No. 12401277 Size 5/8" Kind TRIDENT
Meter Location FRONT OF BASEMENT NEXT TO FURNACE
Stop Box Location 3.2' So. of WALK, 1.6' E. of W. EDGE OF DRIVEWAY.

DISC	DISC CHBR.	GEAR TRAIN	6 TR. SCREWS	REGISTER	FIG. DISCS	REG. BX. COVER	REG. BX. GLASS	BOTTOM	STR. GASKET	STR. BOLTS	COST	GALLONS PER MINUTE 10	2	1/4	REGISTER READING BEFORE REPAIR	AFTER REPAIR	HOT WATER	FROZEN	WEAR	BAND	TEST	DATE IN	OUT	SET
															628170					✓	2-9-42		
															628170						2-14-42		
												100	98	40	230883						2-16-43		
											$1.45	100	100	95	230883						2-17-43		
1												101	99	95									
												—	—	—									

EXCESSIVE QUANTITY USED FOR 5/8

Part of the record of a 28-year old Trident Meter.

THE EFFICIENT operation of a metered system must be based on the study of records. The experience and records of others will give you a fairly accurate guide, enabling you to start a program, adjusting it to the performance of your meters. A meter record card, such as that shown, made out for each meter in your system, will form the basis for your records — the proper use of which will result in more efficient and profitable operation of your meter department.

Trident representatives will be glad to help you work on your problem. No department is too small to profit by Trident Service.

NEPTUNE METER COMPANY • 50 West 50th Street • New York 20, N. Y.
Branch Offices in CHICAGO, SAN FRANCISCO, LOS ANGELES, PORTLAND, ORE., DENVER, DALLAS, KANSAS CITY, LOUISVILLE, ATLANTA, BOSTON.
Neptune Meters, Ltd., Long Branch, Ont., Canada

WATER & SEWAGE WORKS

VOL. 93, No. 6 JUNE, 1946

A Gillette Publication

CONSTRUCTION COSTS AND WATER RATES*

An Attempt at Looking Ahead and Planning Accordingly, While Price Readjusting Is the Order of the Day

By LOUIS R. HOWSON
Consulting Engineer
ALVORD, BURDICK & HOWSON
CHICAGO

THE water utility in a normal American city is a growing institution. If adequate service is to be maintained, that growth cannot be checked. Over the past couple of decades, the average water works has expended for new construction approximately 28c out of every dollar of revenue that it has collected from the consumers. In the latter part of this 20-year period water works construction was curtailed by the war, and accordingly a considerable backlog of work is now awaiting favorable construction conditions.

The Author

As of 1946, the costs of operating and maintaining water utilities are rising sharply, and the net income after operations is correspondingly shrinking. In 1945, nearly 60 per cent of the gross revenue was expended for operation and maintenance, leaving but 40 per cent for fixed charges and capital additions. From 1925 to 1945, an amount equivalent to 62 per cent of the net income from operations was invested in new construction.

The chaotic conditions surrounding the construction industry and the sharply rising costs of labor and materials used by water works raise the following pertinent questions:

1. How much new capital will be required to finance the normal construction program of water utilities at the prices likely to prevail in the decade following 1946?
2. Will the 1946 water rates provide the funds necessary to operate and maintain the properties and extend them in the future as in the past? or
3. Will it be necessary to increase water rates, and, if so, how much?

As every water works should be self-supporting and self-perpetuating, it is apparent that adequate rates and revenues are essential. It is not too early to appraise the effect of the war and governmental policies on the future of water works.

*This paper, presented before the American Water Works Ass'n in St. Louis, Mo., on May 10, 1946, is here published by permission of the Association.

Construction costs have more than doubled since 1932. They have risen 7 per cent the first four months of 1946, and the end is not in sight.

Every war leaves industrial turbulence and rising costs in its wake. While our emergence from World War II is so recent and the maladjustments arising from the war are so serious that accurate forecast is impossible, a study of the effect of prior wars will assist in charting to some extent at least the probable course which construction costs will take following World War II. There has been a price "spree" during and after all wars. World War II differs from its predecessors only in that there was a 10-year psychological "spree" before the war. Also, in this war the federal government introduced a new element by simultaneously adopting the conflicting economic policies of higher wages and incentive payments to labor and price curbs or ceilings on commodities. This practice continues.

Such interference by government with economics makes the present a most difficult time to forecast construction costs or to chart future procedure. We must plan and stake our money on the future, however, even though one Washington radio address can upset a whole economy so far as the construction industry is concerned.

Backlog of Construction Plans

In normal times, water works expend approximately $125,000,000 each year for new construction. When V-J Day arrived, plans for nearly $800,000,000 worth of water works construction had either been prepared or were in preparation. There was a total of approximately $24,000,000,000 worth of construction of all types in the design stage at that date. If construction from this vast reservoir of work proceeds normally, it will provide direct work for approximately 3,000,000 men and, indirectly, for many more. Under the conditions now prevailing, much of this work will never go

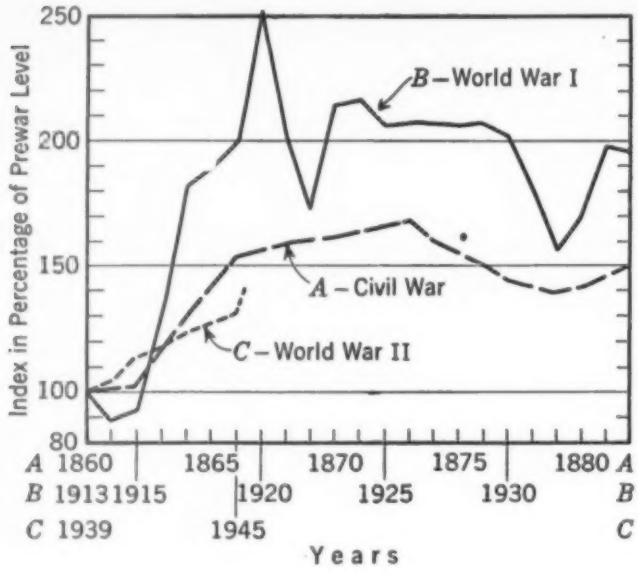


Fig. 1—Effects of Civil War and World Wars I and II on Prices During and After these Major Wars.

forward; and if costs get too high the public will refuse to pay the prevailing prices, and only the most urgent of the work will go forward at all. This fact can possibly be best illustrated by the housing situation, which, incidentally, is not wholly an outgrowth of the war. During the decade of the thirties, at a time when our federal expenditures averaged twice as much as during the roaring twenties, and when in the 8 years from 1932 to 1940 construction costs increased 55 per cent, there were but one-third as many housing units built as in the prior decade. Numerous recent housing surveys have disclosed that people are thinking realistically about what they can afford for housing, and most people are inclined to postpone building if the house they want is going to cost more than the price they had in mind.

A similar statement might be made with respect to water works construction. Approximately 80 per cent of all American water works are now municipally owned. Most of them finance their improvements from earnings. Whether publicly or privately owned, if the cost of the improvements mounts too high, those improvements must either be foregone or the rates for water service must be increased sufficiently to cover the increased costs.

History as a Guide

It is possible to draw reasonably accurate conclusions from studies of the effect of prior wars upon costs of living or costs of construction for nearly 200 years back. Beginning with the Civil War period, the data are conveniently at hand. The Civil War resulted in a rapid increase in prices up to approximately 75 per cent above those prevailing just before the war in 1860, and these prices did not recede until 1873, after which there was a continual recession for a 5-year period. The low point in 1878 was approximately 40 per cent higher than the prices prevailing in 1860.

Similarly, after World War I, prices continued to increase until the summer of 1920, after which there was a period of about 2 years during which both wages and construction costs dropped materially, then recovered to a comparatively stationary plane which was approximately double that of 1913. This level remained quite constant until 1930. In 1930 a second recession began. By 1932, construction costs had receded to a low point which was slightly more than 50 per cent above those of 1913. Since 1932, construction costs have continued to increase until at the present time they are three and one-half times what they were in 1913 and more than double what they were in 1932.

For comparative purposes, the cost factors during and after World War I and the Civil War and up to the present time with respect to World War II are shown in Fig. 1. It will be noted that due to the curbs or ceilings on material prices during World War II the increased cost of construction above that at the beginning of the war was less in World War II than in either the Civil War or World War I. Since the so-called "labor policy" of the federal government was revealed in the early months of 1946, however, construction costs have risen at an unprecedented rate and are still on the increase. Where the construction costs of the future will lie cannot be definitely predicted except that it can be asserted with reasonable confidence that construction costs will never again be less than 50 per cent above those prevailing in 1939. It is believed that aside from minor recessions, possibly the result of too avaricious demands by labor, construction costs of the next decade will average 60 to 75 per cent above those of 1939.

Figure 2 shows the *Engineering News-Record* construction cost index for each month from 1913 to April, 1946. It will be noticed from this diagram that the construction cost index is now 62 per cent above what it was in the boom year 1929, and that during the depression years of 1932 to 1940 costs increased 55 per cent. During these 8 years, public-financed construction averaged 40 per cent of the total and but one-third as many houses were built as during the corresponding boom period of the twenties, when public construction averaged only 20 to 25 per cent of the total.

Are Wages Reflected in Construction Cost?

In recent months we have heard many statements, mostly from Washington, to the effect that wages could be materially raised without more than a very minor effect upon price levels. No opinion is expressed herein with respect to the relationship between wages of labor and costs in any other than the construction industry, but in that industry the relationship is practically a direct one.

Figure 3 shows three graphs: the *Engineering News-Record* construction cost index, the hourly wage rate for all building trades, and the hourly wage rate for

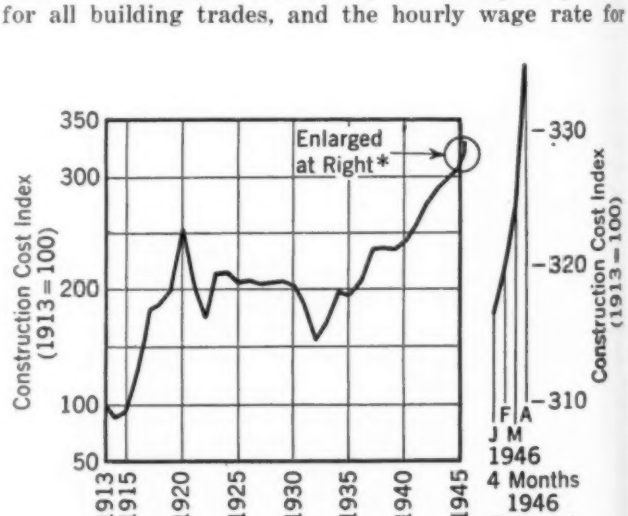


Fig. 2—E.N.R. Construction Cost Index for Years 1913-1945. *(Index for first four months of* 1946 *enlarged on right.)*

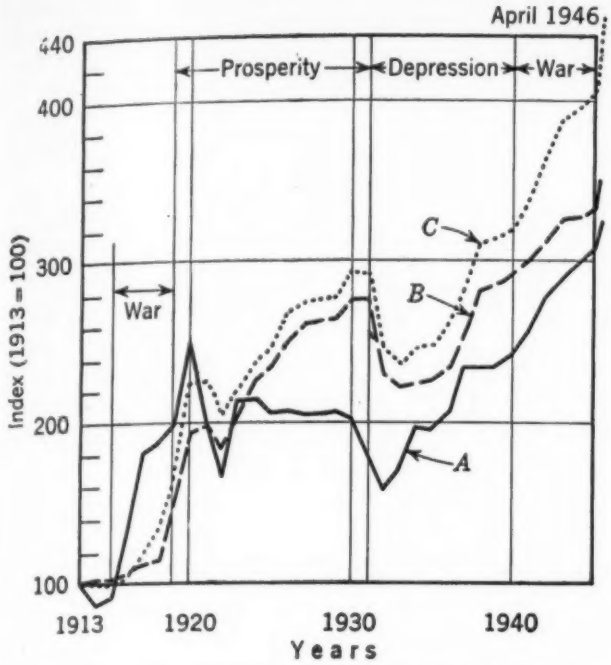


Fig. 3—Comparison Between Construction Costs (A); Hourly Wage Rates for Common Labor (B); Hourly Wage Rates for All Building Trades (C)—for Years 1913-1946.

laborers and helpers—all from 1913 to 1946. Over the 33-year period, the *Engineering News-Record* construction cost index climbed to the extent of 75 per cent of the average percentage rise of common and skilled labor. In the shorter upswing during World War II, that is, from 1939 to April 1946, the construction cost index increased 42 per cent, whereas the average of common and skilled labor increased 34.5 per cent.

This close relationship also exists during periods of decreasing labor and construction costs. For instance, at the beginning of the depression, from 1930 to 1932, the *Engineering News-Record* construction cost index decreased 23.1 per cent, as compared to the average reduction in common and skilled labor rates of 25.2 per cent. In the long upswing from 1932 to April 1946, the *Engineering News-Record* construction cost index rose 114.5 per cent, as compared to the average increase in common and skilled labor hourly wage rates of 103.5 per cent.

The close relationship is further illustrated by Fig. 4. On this diagram the three lines represent respectively the *Engineering News-Record* construction cost index; the cost of 6-in. mains laid in Louisville, Ky., platted for each year from 1940 to 1945 except for 1944, when so small a footage was laid as not to be representative; and the *Engineering News-Record* common labor wage rate. The points on all curves are platted with respect to the percentage relationship which each year's cost bears to the cost in the year 1940 taken as 100. During the period covered by this graph, Louisville laid an average of approximately 6 miles of 6-in. mains per year.

These simple graphs and analyses of labor wages—construction cost relationships which could be enlarged indefinitely—should convince the most skeptical that in the construction industry there is a direct reflection of labor rates in construction costs. As a result of the national labor wage policy there will be fewer and poorer houses built. In the author's opinion, the economic policies which have already increased construction costs 60 per cent above 1929 levels and 115 per cent above 1932 levels do not justify the building of tomorrow's slums today. Neither does he believe that water works, the most vital of all utilities, should have their essential services or expansion curtailed by such policies. But that will be the inevitable result unless water rates are also raised.

Dollars vs. Structures

Practical water works men know that every time 1,000 persons desire new service from the water system, the water works must lay approximately 2 miles of pipe, install 200 services, set 200 meters and add other construction essential to supply the water requirements. The physical structures must be supplied whatever the cost.

Although we have become numbed to the use of astronomical figures, we are still impressed by the statement from Washington that we are planning for a $15,000,000,000 construction industry by 1950. What they should be more concerned with is "How many structures will that build?" It is for the purpose of throwing some light on this picture that Fig. 5 is presented. The upper line of this figure shows the total construction volume as reported in the bulletins of the U. S. Department of Labor. The lower line represents the amount of construction which that expenditure produced, being the dollars expenditure in the upper line divided each year by the *Engineering News-Record* construction cost index (Fig. 2). It will be noticed that the divergence between the two lines has steadily increased since 1932.

The extension of the diagram beyond 1945 is based upon government forecasts for the dollar curve and reflects the author's forecast as to construction costs in the lower curve (the construction cost index for 1950 was taken to be 400). It will be noted from this diagram that although the government's estimates for the dollar value of construction for 1950 are approximately 50 per cent higher than the dollars expended for construction in the boom year 1929, the net result will be only approximately 60 per cent as much construction in 1950 as in 1929. It is structures not dollars in which we are housed, and it is with physical construction that we must supply water consumer needs. When so interpreted, the Washington figures are much less impressive.

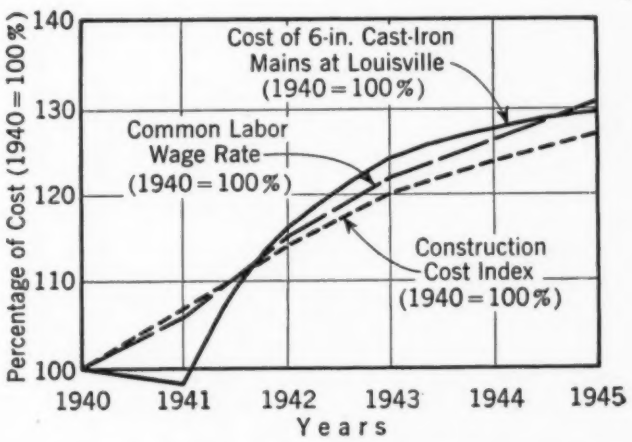


Fig. 4—Comparison Between Construction Costs, Cost of Common Labor and Cost of 6 in. Cast-Iron Mains During the Past 5 Years, 1940-1945.

(Ed. Note: It is well to point out that since, unlike the situation during and after the last World War, the price of cast-iron pipe has remained practically stationary, the increased cost of labor accounts for essentially the entire cost increase for water mains since 1942.)

TABLE 1

Growth in Invested Capital of 100 Water Works Plants

	Municipal Plants	Private Plants	Combined Total
Capital invested in 1925....	$141,659,533	$213,293,113	$354,952,646
New capital invested—1925-1945	$152,396,225	$ 84,246,899	$236,643,124
New capital invested—yearly average	$ 7,619,811	$ 4,212,345	$ 11,832,156
20-year growth in capital—%	107+	39.6	66.7
Average number of customers over 20-year period	683,794	1,014,926	1,698,720
Weighted average annual capital expenditure per customer	$11.10*	$4.15	$7.09
Approximate average number of people served (1925-1945)	4,880,000	4,060,000	8,940,000
Approximate weighted average annual capital expenditure per capita.....	$1.56	$1.04	$1.34

*High, due to effect of Chicago's high ratio of population to customers (approximately 8.7:1).

Application to Water Utilities

No normal water works is static. Even in communities where population growth has leveled off, demands created by rising standards for water service require continuing expenditures for new construction. In order to measure the extent to which the capital investment in water works properties has been increasing over the past two decades, the statistics of nearly 100 water works were studied with respect to the growth in capital investment, the number of customers attached to the system, and the growth in gross revenues and operating expenses. These basic data have been further studied with respect to probable construction costs of the future, the effect of rising costs of operation and maintenance upon net income, and the ability of the water utilities to secure from earnings the funds necessary for expansion.

Growth in Invested Capital

Data available in the author's office relative to the growth in capital investment of a number of water works properties were supplemented by the generous response by the management of both private and municipally owned water works to whom requests were sent for information. Data were requested and furnished with respect to:

1. Undepreciated book costs as of Dec. 31, 1925, and Dec. 31, 1945.
2. Number of customers attached to the system as of Dec. 31, 1925, and Dec. 31, 1945.
3. Gross revenue for 1925 and 1945.
4. Operating expenses before depreciation for 1925 and 1945.
5. Where readily available, the expenditures for operating labor in 1925 and 1945.

The data secured cover the statistics on 100 water works properties serving approximately 1,500,000 customers in 1925 and over 1,900,000 customers in 1945. Of the total invested capital in these 100 plants, which amounted to $591,595,770 in 1945, 49.7 per cent was invested in municipal plants, and 50.3 per cent in privately owned plants. The invested capital had grown from a 1925 level of $354,952,646 or, expressed in dollars per customer, it increased from $238 in 1925 to $310 in 1945.

Although the 1945 total investment was divided almost evenly between municipal and private plants, the number of private plants because of their smaller size made up approximately 90 per cent of the total number studied.

The growth in the invested capital in these 100 plants is summarized in Table 1. It will be noted that over the past two decades these water works, which represent 100 communities and more than 10 per cent of the total number of people served by public water supplies in the United States, expended annually for new construction an average of $1.34 per capita served. This general average secured from the study of equal investment in private and public plants is undoubtedly low, as the municipal plants with their comparative freedom from taxation have expended more per capita for new construction. As 80 per cent of water plants are municipally owned, including all of the largest cities, it is believed the true average annual expenditure per capita is approximately $1.45. With 80,000,000 people having public water supply service, the water utilities have been expending approximately $120,000,000 per year for new construction. This money was expended when construction costs were much lower than in 1946. To produce the equivalent structures in 1946 would cost approximately $200,000,000, and it is probable this annual requirement will exceed $250,000,000 when the full effect of present labor wage policies is left.

As an illustration of the comparative growth in invested capital and number of customers, the statistics of these 100 water works show that in the two decades from 1925 to 1945 the invested capital increased 67 per cent while the number of customers increased but 27 per cent, i.e., the investment grew at a rate two and a half times as fast as the number of customers. Clearly, water works are not static nor is their demand for capital simply a reflection of growth in population served. Apparently water works capital requirements are influenced fully as much by developments in methods of treatment, for example, such as filtration, iron removal and water softening, as by community growth.

Water Revenues

The figures relative to the growth in gross revenue and operating expenses are also interesting. Analysis of the operating statistics of the 100 water works is summarized in Table 2. It will be noted that there has been a growth both in gross revenues and in operating expenses before depreciation, gross revenues per customer registered, a gain from $26.15 to $32.10, or 23 per cent in the two decades. Operating expenses too have not been static, increasing from $12.70 to $17.45 per customer, or 37 per cent in the two decades. The net income has remained relatively constant, being $13.45 per customer in 1925 and $14.65 per customer in 1945, a gain of but 9 per cent. During the same period the invested capital increased from $238 to $310 per customer, a growth of 30 per cent. Obviously, the rate of return earned on invested capital decreased during the 20 years.

The gross revenue in 1945 was generally at an all-time peak resulting from the high industrial use occasioned by the war. It is probable that quantity of water sold in the future years will be somewhat less, but so far as

TABLE 2

Operating Statistics of 100 Water Works Plants

	1925		1945	
	Total	Per Customer	Total	Per Customer
Gross revenue $39,276,912		$26.15	$61,139,286	$32.10
Operating expense before depreciation 18,979,223		12.70	33,328,177	17.45
Net income before depreciation 20,297,689		13.45	27,811,109	14.65

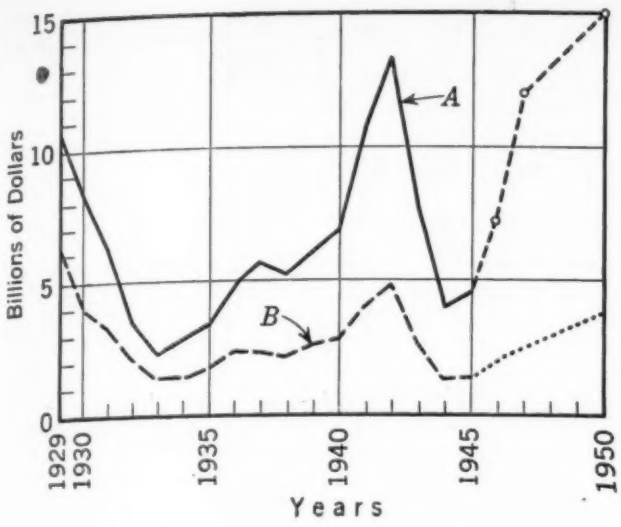


Fig. 5—Dollars vs. Structures.

(A) represents construction volume as reported by the U. S. Dept. of Labor in dollars spent and predicted future construction, also in dollar values. (B) represents dollar value converted to comparative volume of construction in terms of actual structures. Note the increasing divergence of the two lines since 1932. *More importantly, note what is projected for the period immediately ahead.*

figures are available to date, it would appear that 1945 revenues should be maintained due to residential customers taking over part of the industrial water and paying a higher rate for it.

The net income for the 100 plants over the 20-year period from 1925 to 1945 has averaged about $14 per customer per year. The capital additions during the same period averaged $7.00 per customer per year, an amount equivalent to 50 per cent of the net income. The municipal plants studied spent approximately 84 per cent of their net income before depreciation for construction, and the private plants, about 27 per cent. Taken together, public and privately owned water utilities spent 24 per cent of their gross revenue and 50 per cent of their net income before depreciation for capital additions.

Increase in Operating Expenses

Operating expenses have grown more rapidly than income. In 1925, operating expenses took but 48.5 per cent of the gross revenue; by 1945 this had increased to 54.5 per cent.

Operating and maintenance costs in 1946 are rising sharply. It would appear likely that labor costs which constitute roughly 45 per cent of the operating cost of the average water works will follow the "national policy" pattern and be raised about 17.5 per cent within the next few months. Fuel and electric power (electric rate schedules usually carry a fuel clause) constitute approximately 13.5 per cent of the operating expenses of the average water works. As an outgrowth of the present coal strike and the adjustments which will follow its termination, it is likely that the cost of fuel will be raised approximately 10 per cent. Materials, supplies, taxes, etc., which constitute the remainder of the operating expense item, may be expected to increase by approximately 15 per cent. The effect of these already apparent increases on the annual operating cost per customer of water utilities in general is estimated as follows:

Fuel or power at 10 per cent of 13.5 per cent of operating cost	$0.24
Labor increase at 17.5 per cent of 45 per cent of operating cost	1.38
Other materials and supplies at 15 per cent of 41.5 per cent of operating cost	1.08
Total increase per customer	$2.70

The total of the increases above estimated as applicable to fuel, labor and other operating supplies, aggregates $2.70 per year per customer, or approximately a 15.5 per cent increase in operating expenses which can be anticipated within the very near future.

This increase in operating expenses will correspondingly reduce the net income so that instead of there being a net of $14.65 per customer as in 1945 there will be but $11.95 net per customer. This $11.95 net income, however, when expended for new construction, will purchase only approximately two-thirds as much as it would have purchased in 1940. Since in the past 50 per cent of the net income of both public and private plants as an average group has been expended for other than new construction, it can be assumed that at least this much, or $7.30 per customer, will be needed in the future, and this assumption will necessarily result in a lower rate of return on capital.

Deducting this $7.30 from the estimated net income of the near future, or $11.95, leaves $4.65 per customer for new construction as compared to the $7.00 spent each year in the last two decades. But $7.00 will not pay for as much construction as in prewar times; to maintain the same volume of construction at costs prevailing post war will require at least $11.20 per customer. Since there will be but $4.65 per customer available, the gross revenues must be increased approxi-

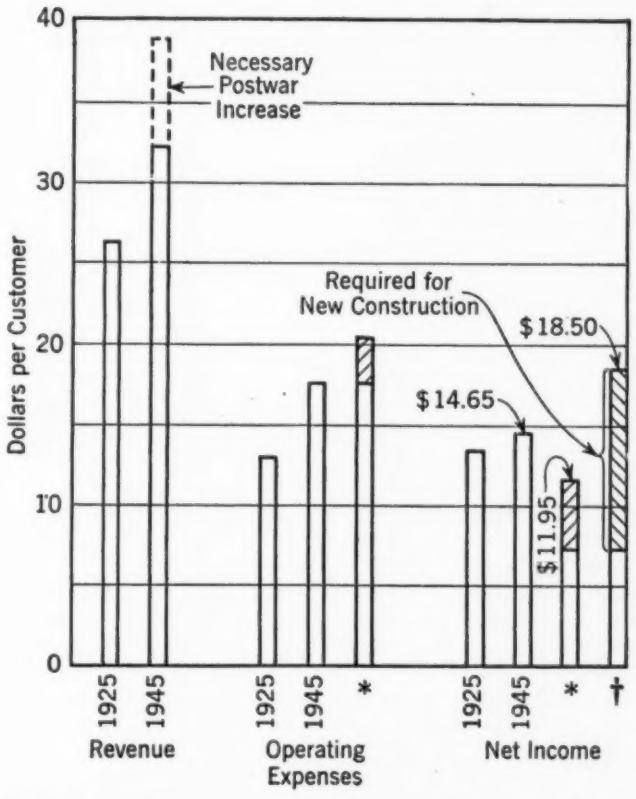


Fig. 6—A Study of Water Works Revenues, Operating Expenses and Net Income—Yesterday, Today and Tomorrow.

(Expenditure vs. income in terms of dollars per customer per year is chosen as the fairest measuring stick available to reveal what has happened and what must happen to water rates to compensate for the "bulge" that has come into our national economics line since the end of the war.)

mately $6.55 per customer, or in round numbers, 20 per cent above those of 1945. This is equivalent to about $1.40 per capita per year (Fig. 6).

1946 is not too early for each plant management to appraise its individual requirements and status in comparison with the general averages presented herein and start appropriate adjustments.

WATER COMPARED TO ELECTRIC AND GAS UTILITIES

In a discussion of this subject with Linn Enslow, Chairman of the A. W. W. A. Program Committee, he raised a question which will probably be asked of many Association members, namely, why should it be necessary for water works to have increased rates when many electric companies have reduced their rates since the war? There are numerous reasons for this difference, among the more important being:

1. The per capita use of water increases very slowly, whereas the use of electricity is rapidly expanding. From 1925 to 1945, water works revenues per customer increased but 33 per cent, and part of this reflected rate increases. In the corresponding period the residential use of electricity per customer tripled. The average residential electric bill exceeds $30 per year. The average residential water bill is less than half as much.

2. Water utilities, like houses, are local and individual. Electric utilities are continually developing toward centralized generation and long-distance transmission. Electricity can be transmitted over a high-tension line for a long distance to a city of 10,000 population at a cost of $2,000 per mile of line. If the electric energy is generated in that 10,000 population town by coal it will take approximately 2 lb. of coal per kwhr. When generated in a large central station and transmitted to this city, the energy is available at less than 1 lb. of coal per kwhr. There is no analogous possibility in water works.

3. High-tension transmission has tied in great areas such as that from the Tennessee Valley to the Great Lakes and from the Appalachians to the Mississippi River. This makes available to the Chicago area the cheap hydroelectric power of TVA at times of abundant water supply and surplus generation in the TVA system, and during periods of drought and insufficient water in TVA makes available to that area the steam-generated power from the Chicago super-power development. No such pooling of facilities, which minimizes reserve equipment requirements, is practicable with water works.

4. Water works revenues have always been low compared to electric revenues. In nearly any city, water works revenues are but from 10 to 20 per cent of electric revenues. There is not the latitude in which to work with water revenues that there is with electric revenues. During the war period, some electric plants paid, as excess profits taxes, as much as $10.00 per capita served. No comparable payment by any water works is known to the author.

5. In comparison with natural gas, water is incompressible, an important factor in determining the distance over which it can be transmitted. Gas follows Boyle's Law, and, by compression to high pressures, can be transmitted economically over long distances. Natural gas from Texas is used practically to the Atlantic seaboard.

6. Water works, due to health and fire protection requirements, must maintain reserves not required of other utilities. Gas and electric service may be and are subject to infrequent but nevertheless recurring interruptions. A very large percentage of all the water works systems in the country have not had an interruption in service for decades. As a result, water works operate at a disadvantageous "load factor" as compared to gas and electric utilities.

History Repeats Itself

In the April, 1925, *A. W. W. A. Journal*, the late Leonard Metcalf, Past-President of the Association, presented a timely discussion titled "Financial Status of Water Works." Mr. Metcalf's discussion was prepared in 1925 and accordingly reflected several years' experience following World War I. He reported that in the interval from 1915 to 1923, water works gross revenues had increased 57 per cent, of which 20 per cent, or more than a third, was gained by changes in rates. He stated this increase was an important help in enabling water utilities to serve the public adequately, but added. "It may fairly be anticipated then that under average conditions there will be an advance in water rates of at least one-third in the next few years if water works values are readjusted with those in conformity with other property."

CONCLUSIONS

From the foregoing discussion it is believed certain general conclusions can be drawn:

1. The growth of public water supplies must continue. By and large, the funds necessary to sustain that growth must come from revenues for service rendered.

2. Construction costs in the early part of 1946 are about 40 per cent above those of 1939. Aside from minor recessions, it is believed these costs will continue to increase to a general average over the next decade of 60 per cent to 75 per cent above 1939, and even in time of the next depression will not recede to within 40 per cent to 50 per cent above costs prevailing in 1939.

3. Washington's labor policies are in large part responsible for these increased costs. Whatever may be the facts with respect to commodities, it is indisputable that construction costs directly reflect increased wages to labor.

4. At the present time the atmosphere surrounding construction work is so surcharged with uncertainty as to make it impossible to secure satisfactory fixed prices on many types of work. Of the immense backlog of water and sewage works construction awaiting contract, much will be deferred or abandoned.

5. Some public works are being deferred because Washington has not declared itself with respect to federal aid on public works projects. Most cities do not want federal aid, but the possibility that there may eventually be federal participation is a strong deterrent to many cities which otherwise would proceed without it. Washington should declare itself on this matter.

6. Rising costs of operating and maintaining water works will seriously cripple the expansion of water works unless there is an increase in gross revenues of approximately 20 per cent, equivalent to $1.40 per capita per year.

7. Water works management must be alert to its responsibilities to maintain service and make improvements as needed. To make this possible, they must see to it that their rates are so fixed as to provide the funds necessary for needed construction.

A. W. W. A. HOLDS MOST SUCCESSFUL CONVENTION OF ALL TIME

Record Attendance at St. Louis Matched by Record Exhibits

Presidents

L. N. Thompson
Supt. & Genl. Mgr.
Water Dept.
St. Paul, Minn.
(Retiring)

W. R. La Due
Chief Engr. & Supt.
Water & Sewage
Akron, Ohio
(Incoming)

AS was predicted, the 66th Annual Conference of the Am. Water Works Association in St. Louis, Mo., May 6-10, proved to be the largest in the history of the Association. The paid registration was 1517, and the manufacturers' exhibits, of quality and proportions not before equaled, and occupying 119 booths in the exhibit hall, constituted another record.

Awards and Honors

At the closing banquet the following awards were made.

Honorary Membership was conferred on John R. Baylis, Physical Chemist of the Dep't of Public Works of Chicago, who was cited "for his outstanding contributions to the field of water treatment." Mr. Baylis had previously been the recipient of the Goodell Prize of A.W.W.A. for his scientific papers and also of the Geo. W. Fuller Award.

[Ed. Note: Since so many of Mr. Baylis' contributions to the technical literature on water treatment have appeared in *Water and Sewage Works* under his name as Editorial Associate, we take especial pleasure in seeing such recognition come to one to whom such recognition is due. Mr. Baylis has twice been awarded the Dexter Brackett Medal by the New England Water Works Association for his contributions to the literature and knowledge of water treatment.]

Honorary Membership was also conferred upon E. G. Ritchie, former Chief Engineer of the Metropolitan Water District of Melbourne, Australia. Mr. Ritchie received the honor in absentia, since he could not be present.

The **John M. Diven Medal**, the highest award of the Association, was presented to James C. Harding, Commissioner of Public Works of Westchester County, N. Y., "in recognition of his engineering skill and leadership of the committee which developed the new 'A.W.W.A. Specifications for Deep Wells.'"

Award Winners

J. C. Harding
Comm. Pub. Wks.
Westchester Co.
White Plains, N. Y.
(Diven Medal)

C. M. Riedel
Chem. Soil
Solidification
Chicago, Ill.
(Goodell Prize)

Hosts

Victor Weir
Gen'l Mgr.
St. Louis County
Water Co.
Univ. City, Mo.

Thos. Skinker
Director
Public
Utilities
St. Louis, Mo.

(Co-chairmen——Local Convention Comm.)

The **Goodell Prize**, for the outstanding paper of the year in the A.W.W.A. Journal, was presented to C. Martin Riedel, Chemical Engineer, Chemical Soil Solidification Engineering of Chicago, for his paper "Chemical Soil Solidification and Chemical Sealing of Leaking Concrete" published in the Sept. 1945 issue of the Journal.

George W. Fuller Awards

Because there had been no Annual Convention in 1945 the Geo. W. Fuller Memorial Awards were presented for the two year period. "For distinguished service in the water supply field," these awards voted by the several sections of A.W.W.A. as indicated were presented to the following:

George C. Sopp—California
Chas. J. Des Baillets—Canadian
Keith R. Chinn—Florida
Gustav J. Requardt—Four States
Otto E. Brownell—Minnesota
Earle L. Waterman—Missouri Valley
Percy S. Wilson—New Jersey
Chester A. Truman—Rocky Mountain
Thomas L. Amiss—Southwest
Richard Messer—Virginia
Harry K. Gidley—West Va.
Ernest A. Cleveland—Canadian
Henry H. Hyman—Florida
H. Lloyd Nelson—Four States
Adolph E. Anderson—Illinois
Joseph L. Quinn Jr.—Indiana
Raymond J. Faust—Michigan
Wm. D. Hurst—Minnesota
Otto S. Reynolds—Missouri Valley
Arthur L. Hewett—Montana
John L. Radcliffe—New Jersey

In and About the Convention

At the Annual Closing Dinner

A tete-a-tete between "Bill" Orchard and "Mike" Tiernan

Pres. "Bill" Sherwood addressing the W&S Wks. Mfgr's. Association

Jerry Arnold getting the low-down from Marsden Smith in an exhibit booth

Pres. Thompson making awards during Annual Dinner

James W. Kellogg—North Carolina
Henry G. Watson—Rocky Mountain
Robt. W. Harding—Southwest
Chas. L. Crockett—Virginia
Chas. L. Fox—Western Penna.
Max K. Jones—West Va.

The **Nicholas Hill Cup,** awarded annually to that section showing the greatest membership gain during the year, and based upon per cent member gain, out of the potential membership in the area, was won by the Southwest Section.

The **Henshaw Cup,** awarded annually to that section showing the largest attendance of actual members of A.W.W.A., as against attendance of non-members, was won by the Wisconsin Section.

For continuing to hold the lead of all sections in total membership, the California Section seems to have an unthreatened grip on the famed Old Oaken Bucket—incidentally from a New England well.

[Ed. Note: California is much too big to be supporting a single section in AWWA anyway, wails the runner up N. Y. State Section.]

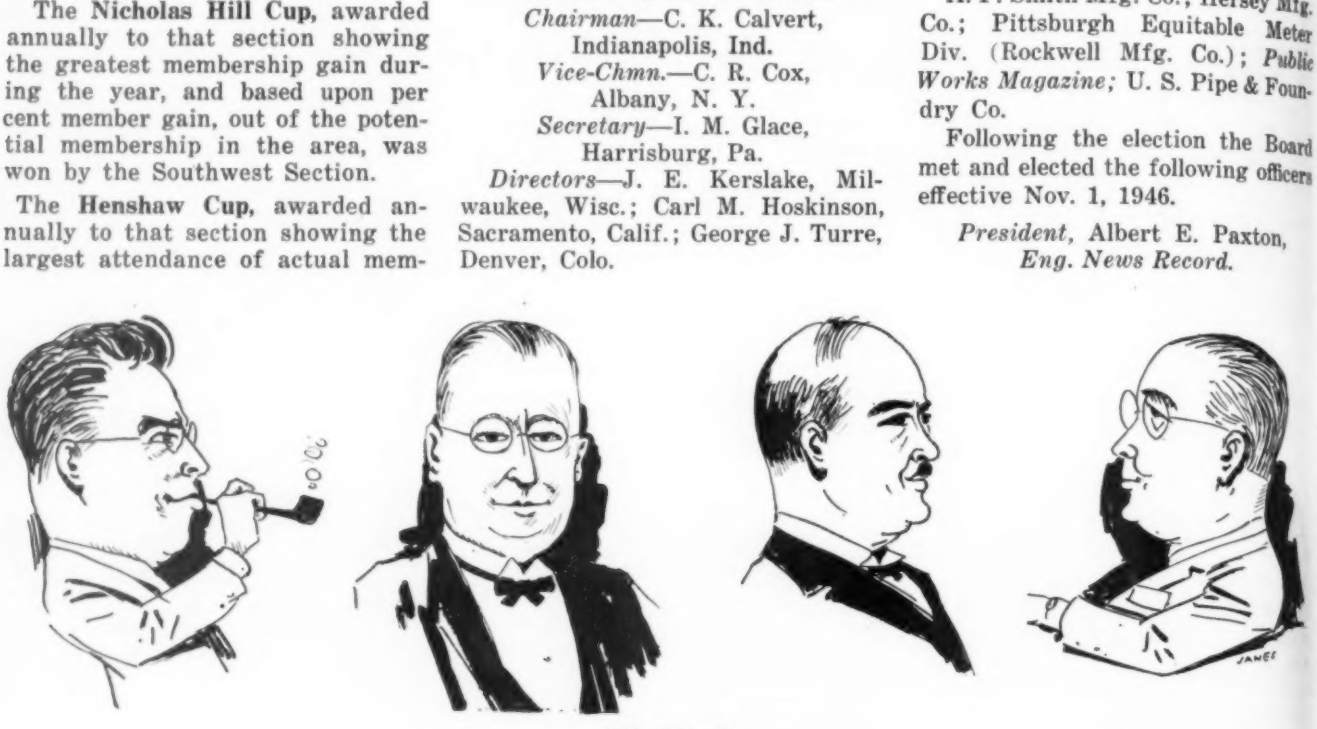
New Officers of the Divisions

The following are the newly elected officers of the three divisions of the Association.

Plant Management Division
Chairman—S. S. Anthony, Augusta, Me.
Vice-Chmn.—M. P. Hatcher, Kansas City, Mo.
Secretary—W. L. McFaul, Hamilton, Ont.
Directors—D. D. Gross, Denver, Colo.; W. C. Morse, Seattle, Wash.;

Finance & Accounting Division
Chairman—C. H. Lamb, Jamaica, N. Y.
Vice-Chmn.—L. A. Jackson, Little Rock, Ark.
Secretary—J. L. Hawkins, Greenville, S. C.
Directors—G. B. Schunke, Seattle, Wash.; J. D. Senevy, Kansas City, Mo.

Water Purification Division
Chairman—C. K. Calvert, Indianapolis, Ind.
Vice-Chmn.—C. R. Cox, Albany, N. Y.
Secretary—I. M. Glace, Harrisburg, Pa.
Directors—J. E. Kerslake, Milwaukee, Wisc.; Carl M. Hoskinson, Sacramento, Calif.; George J. Turre, Denver, Colo.



"Big-Wigs"*

The Retiring President, "Len" Thompson
The New President, Wendell La Due
Immediate Past Pres. "Sam II" Newkirk
The Exec. Sec'y. Harry Jordan

(**As sketched by our thumbnail artist, Guido Janes.*)

The Manufacturers Elect

On May 8th, the Water and Sewege Works Mfrs. Ass'n held its Annual Meeting which this year was a luncheon meeting where the members heard Col. W. F. Rockwell discuss the matter of "Inflation and How Far It May Go." The Colonel predicts yet higher prices and a sustained high tax level until the Nation's debt is reduced sufficiently to warrant tax reductions with safety. His thought is that in good times taxes should properly be high, with the idea that a back-log can be established with which to finance water and sewage facilities during bad times. The manufacturers also discussed the pros and cons of the "Club Room" type of entertainment which has been successfully followed in the Canadian Section for a number of years and only recently in connection with section meetings in the States. It was then voted that the "Club Room" idea was right and sound in principle, and should be continued so long as the Officers of the sections felt that this method of entertainment constituted the overall most effective and satisfactory method.

At the close of the meeting the annual election was held and the following firms were elected to the Board of Governors of the W. & S. Works Mfrs. Ass'n.

A. P. Smith Mfg. Co.; Hersey Mfg. Co.; Pittsburgh Equitable Meter Div. (Rockwell Mfg. Co.); *Public Works Magazine;* U. S. Pipe & Foundry Co.

Following the election the Board met and elected the following officers effective Nov. 1, 1946.

President, Albert E. Paxton, *Eng. News Record.*
Vice-Pres., Daniel J. Saunders, The Permutit Co.
Secretary-Manager, Arthur T. Clark.
Treasurer, Edgar J. Buttenheim, *American City Magazine.*

PUBLIC RELATIONS CONFERENCE

At an open session on the afternoon of the opening day, the Executive Committee of A.W.W.A., the Public Relations Survey Committee, and various members of the association participated in a general discussion of the subject of public relations.

Harry E. Jordan, Secy. A.W.W.A., explained briefly the brochure which he had had developed on the subject. This brochure, titled "Silent Service Is Not Enough," had been made available to the executive committee and the question was raised as to whether or not the brochure should be printed and released to all members of the association.

E. L. Filby, Chairman of the Public Relations Survey Committee, questioned the advisability of re-

leasing the brochure at this time, believing that in its present form it would be more useful to the larger cities, rather than to the smaller communities.

Mr. Filby quoted statistics showing that only 18 per cent of the cities in this country have populations of 25,000 or more. This being the case, Mr. Filby believes that efforts should be concentrated on the smaller communities with the development of a manual to be a matter of gradual growth over a period of five years.

Gerald E. Arnold, San Diego, Cal., suggested the release of single mimeograph sheets, perhaps one each month, with each sheet containing a single idea for the promotion and improvement of public relations.

Melvin P. Hatcher, Kansas City, "doesn't see the end result of the program as a manual"; he believes that manuals are static while the program of public relations must be dynamic. Mr. Hatcher is also of the opinion that specific information on how to do single jobs is better for the small plant than is a broad program outlined all at once.

Leonard N. Thompson, Pres. of A.W.W.A., St. Paul, Minn., countered with the thought that the program must be broad but that the smaller parts, which make up the whole, must be done first.

Dr. George E. Symons, Assoc. Editor, *Water & Sewage Works,* expressed the opinion that the manual is excellent in its organization, ideas, and details of procedure and certainly should be used by the association in the furtherance of its program. The matter of how it is used perhaps needs more careful consideration than can be given at an open forum discussion where the members participating are not acquainted with the material.

Dr. Symons pointed out that many speakers on the subject had been considering the details of public relations, whereas the "question before the house" is whether or not the A.W.W.A. should foster a program of public relations, and if so, how should it proceed. As a personal opinion, Dr. Symons proposed the thought that the Executive Secretary's office should evolve the broad program, with the help of an Association Committee, and guide its future, even to the extent of assigning some person to that work. The actual carrying out, however, of that broad program (i.e., the dissemination of details of procedure for individual communities) should be handled by local spark-plug committees of the various sections.

Other speakers on the subject included **A. P. Kuranz,** Waukesha, Wis., who believes that even municipal water utilities should advertise in the local papers, and **Leon A. Smith,** Madison, Wis., who believes that the New York office should be used as a clearing house for all ideas on the subject.

John Murdoch, New York, emphasized the extremely bad approach to the subject in the attitude of the past which was "the less said about the water works, the better." **Wendell R. LaDue,** President-elect of A.W.W.A., at that time, and himself an astute practitioner of the art of public relations, admitted that not all water works superintendents are born public relations experts. The public relations problem in a community begins at the superintendent's desk. Although a brochure can aid in the education of a superintendent, the mere handing him a brochure does not make him a public relations expert.

W. W. Brush, Editor, *Water Works Engineering,* wants a man in the Association's New York office to study the public relations problem in order to improve the industry. Brush suggests that local section committees meet with this man to develop overall planning and to distribute ideas in order that the work may be done locally. The manual should come later.

No action was taken at the meeting but it was presumed that the Board of Directors of A.W.W.A. will consider the subject further after it has studied the report of the Survey Committee and that some action will be forthcoming at the annual meeting in New York in January.

EIGHT NEW DIRECTORS

Jos. P. Schwada
City Engineer
Dir. of Water
Milwaukee, Wis.

A. B. Manson
Genl. Mgr.
Utility Comm.
Stratford, Ont.

John Hawkins
Supt.
Water Dept.
Greenville, S. C.

H. K. Gidley
San. Engr.
State Dept. Health
Charleston, W. Va.

D. D. Gross
Chief Engr.
Water Comm.
Denver, Colo.

B. A. Poole
Chief Engr.
State Dept. Health
Indianapolis, Ind.

D. M. Williams
Supt.
Water & Sewage
Durham, N. C.

Chas. E. Moore
Genl. Mgr.
Water Dept.
Roanoke, Va.

(The ninth new Director, Frank A. Russell, of the recently organized Kansas Section, was not in attendance.)

PLANT MANAGEMENT AND OPERATION DIVISION

The Plant Management and Operation Division held four sessions, one of which was a joint session with the Finance and Accounting Division, with the presentations devoted to the topic, "Humanics," or "How Do You Get Along with Your Employees?" One of the sessions was devoted to the subject of "Watershed Control" and drew considerable general interest.

Improvements for St. Louis

Although the city of St. Louis has been receiving satisfactory water for many years at reasonable cost from a department that is rapidly

becoming debt free, the fact remains that with antiquated equipment, such cannot be the case indefinitely. For that reason, **Thomas J. Skinker,** Director of Public Utilities, and **E. E. Easterday,** Water Commissioner, have "Planned Improvements for the St. Louis Water Department."

It is proposed to make the Chain of Rocks plant serve the entire city by revisions and additions, with no work to be done on the Howard Bend plant now pumping 20 mgd. from the Missouri River. The Chain of Rocks plant is steam operated, with all equipment, including boilers and pumps, nearing the end of its useful life. Conduits for clear water transfer to storage are also old and subject to failure in the not too distant future.

Plans include changes in design, replacement of old pumps and boilers, also old conduits as well as the pumping equipment at the high level pumping stations. Other new features will include a new reservoir that will improve water distribution, a new laboratory to improve control of purification, production of power for operation from powdered coal fired boilers, and 6,900 volt steam-turbine generators.

The total plant capacity of the redesigned and rebuilt plant will be 240 mgd. and there will, as now, be two levels of distribution, but both quantity and pressure will be the same in both systems, a condition which does not exist now. The new plant will cost $18,400,000, including the conduits and reservoir, but its construction will save more than $900,000 a year in operating costs. The water department now has $18,000,000 in funds, of which $11,000,000 is in cash. There appears to be no reason why this improvement cannot be made soon.

Committee on Municipal Water Works Organization

The progress "Report of the Committee on Municipal Water Works Organization" was presented by its chairman, **Wendell R. LaDue,** Ch. Engr. and Supt., Bureau of Water and Sewage Works, Akron, Ohio. With an organization of 25 members covering three separate regions, the committee had reviewed the problems of management and expressed the purpose of good management as a combination of good service, sound financing, and sound administration.

A 44 per cent return on questionnaires sent out by the committee is available to date. Of these 36 per cent indicate commissioner-board type of governing body is the best, but other types are good, too, and several persons believe that if a system works well it should be let alone. Mr. LaDue believes this type of argument is open to questioning.

The committee proposes to continue its survey and to resume intensive efforts to obtain returns of questionnaires. It also proposes closer contact with all plants and a study of forms and ordinances. The question of diverting funds to other departments will also receive further study. Problems must be solved at local levels; the A.W.W.A. can only point the way.

Water Department Reports

To the title of the paper, "Water Department Reports—Why They Are Prepared—Who Reads Them," the author, **Melvin P. Hatcher,** Director, Water Dept., Kansas City, Mo., said the following should be added, "What other persons should read them, and how can we increase the circulation?"

Annual reports are the storehouse of information for management and a source of exchange information. While many superintendents do not prepare annual reports, Mr. Hatcher believes such reports are well worth while. Kansas City reports are distributed as follows:

	Per cent
Consumers	36
Other utilities	20
Libraries	16
Tech. mags. and health depts.	15
Local organizations	10
Cons. engrs.	4
Miscellaneous	9

Hatcher is of the firm belief that the report should be readily comprehended by the lay public but should not be written at a low intelligence level. Full page tables should be omitted as they tend to "scare" the reader. Diagrams and charts should be simple yet completely expressive of the idea and information desired to be conveyed.

Inquiry by Hatcher revealed that in one city the annual report receives a distribution locally of one report to each 3,300 persons served, whereas another report with 70 per cent of its distribution locally sets a record of one report to each 70 consumers. Certainly the former distribution is too poor and the latter may be more distribution than is necessary, but the latter is to be preferred over the former.

Meter Cephalalgia

Reporting for the Committee on Meter Specifications, **Samuel F. Newkirk, Jr.,** Engineer and Supt., Board of Water Commissioners, Elizabeth, N. J., said that develop-

In the Spot-Light at St. Louis

The President of A.S.C.E. W. W. Horner St. Louis Cons. Engr.

"Vic" Weir St. Louis County Water Co.

"Tom" Skinker Director of Water St. Louis

(Co-Chairmen Convention Comm.)

"Jim" Harding Comm. Public Wks. Westchester Co., N. Y. (Diven Medalist)

ing meter specifications was not just a pain in the head, it was the greatest headache in history, hence the title. The task of trying to please everyone made the problem even more difficult. Before the work was finished, seven meter manufacturers had been visited and consulted.

At the outset it was decided that there would be no Class B meters; there was to be but one specification, for Class A meters. It was also decided that the committee was not designing meters and therefore was not concerned with the looks of the meter. Steps in the work included the development of specifications for displacement meters, then specifications for current and compound meters, and finally specifications for fire flow meters.

The new specifications for displacement meters include all meters having positive action, thus replacing the specifications of 1921, which were for disc meters only. Meters must have a registration of 98.5 to 101.5 per cent with a 95 per cent accuracy at minimum test flow of one quarter gallon per minute.

The new specifications set a maximum allowable head loss and a new thread specification, which will make for uniformity and improve interchangeability of meters.

The register dial is still chaotic, but that is a matter of design. Some thought was given to the possibility of having meters register in cubic meters but no action was taken on the standardization of registration and there will continue to be cubic feet, which, according to Mr. Newkirk, is a descendant of the foot, which was taken as two-thirds of the length of the forearm of the King of England a few centuries ago, and there will continue to be the gallon, which also has an antique origin having to do with the measurement of wine.

The rate of operation was included in the specifications and an overall length specified.

For current meters for large flow only it was impossible to adopt a standard type of meter. Limitations were placed on loss of head and accuracy of measurement was upped from 90 to 95 per cent. Specifications for fire service meters were revised along the lines of the current and compound meters.

In this work of the committee, a similar committee of the New England Water Works Assn. assisted and concurred in final decisions.

CHAIRMEN OF THE DIVISIONS

Plant Management Div.
H. H. Brown
Supt. of Water
Milwaukee, Wis.
(Retiring)

S. S. Anthony
Supt. of Water
Augusta, Me.
(Incoming)

Finance & Acctg. Div.
Geo. B. Schunke
Asst. Water Supt.
Seattle, Wash.
(Retiring)

Carter H. Lamb
Vice-Pres.
Jamaica Water Co.
(Incoming)

Purification Div.
Geo. J. Turre
San. Engr.
Water Commission
Denver, Colo.
(Retiring)

Cecil K. Calvert
Supt. Purification
Ind. Water Co.
Indianapolis
(Incoming)

Scheduled Maintenance

W. Victor Weir, Vice Pres. and Gen. Mgr., St. Louis County Water Co., introduced the subject of "A Scheduled Maintenance Program for Water Works" by saying that scheduled maintenance is to a water works what preventive medicine is to the human anatomy. What a scheduled maintenance program is to accomplish and how a program should be set up was presented by **H. O. Hartung,** Chemist, St. Louis County Water Co.

If scheduled maintenance is *preventive maintenance,* then these operations should be included: investigation of noise, keeping equipment clean, protection against environmental deterioration, correction of conditions causing excessive heat, elimination of vibration, proper lubrication, and inspection for wear.

The value of preventive maintenance is apparent in the assurance of continuity of service and distribution of work for maintenance personnel.

In establishing a preventive maintenance program, it is essential that a proper organization be set up with a definite assignment of responsibility without overburdening keymen with routine duties. Flexibility of organization, clear understanding of the meaning of preventive maintenance, proper tools, and spare parts are needed to make the program work.

The initial step in setting up a scheduled maintenance program is to study the equipment and determine the amount and frequency of such maintenance.

The program must depend on a system of records which will make possible routine assignments, allow easy changes in the schedule if needed, and will allow responsible persons to know when and how the work is to be done as well as by whom and when it is completed.

The scheduled maintenance program at St. Louis County Water Co. basically consists of four cards: Assignment Card, Office Property Card, Property Card, and Calendar Card; and four files: Work Reminder File, Current Work File, Property Maintenance Directory, and Calendar Maintenance Directory. At first reading this seems to involve a considerable amount of record keeping routine, but Mr. Hartung explained the function and operation of each of these cards and their relations to the various files. Although the cards and files do not run themselves, they do not involve as much work as one might expect.

Scheduled preventive maintenance is designed to eliminate breakdowns, unplanned equipment outages, and to maintain operation at top efficiencies. The program has proven itself at St. Louis County Water Co. and resulted in comparatively trouble-free operation.

The topic was first discussed by **Paul Weir,** Asst. Gen. Mgr., Atlanta

Water Dept., who said that a water department had but one commodity to sell—service—and that service could be provided only if breakdown is prevented. A scheduled maintenance program not only will prevent that breakdown, but will also eliminate unnecessary cost and produce a familiarity with equipment.

Details will vary in individual plants, but it was suggested that a start should be made on a simple program, enlarging it as necessary. Weir referred to L. H. Enslow's suggestion of 1932 for the keeping of records of procurement of materials. Such records are a part of preventive maintenance. "Preventive maintenance is good housekeeping," concluded Mr. Weir.

Vance C. Lischer, Cons. Engr., Horner & Shifrin, St. Louis, said that the system *is* applicable to small plants. It must revolve around a card system, but one can develop his own card system, which may be expected to change as needs develop. Mr. Lischer referred to the Army Technical Manuals, obtainable from the Supt. of Documents, Govt. Printing Office, Washington, D. C. Manual EM 5-660 is for water works.

B. A. Poole, Chief Engineer, Ind. State Bd. of Health, and the man responsible for the development of these manuals during the war, said that there are only 100 to 150 basic cards necessary to the system.

Flow in Concrete Pipes

A few years ago the Water Department of Chicago installed concrete pipe mains of 30 and 36-in. dia. The story of this installation was reported by W. W. DeBerard and W. B. Weldon in *Water Works and Sewerage* in Oct., 1943. The story of leak tests and the flow coefficient tests on this line was told at the meeting in St. Louis by **J. L. Irwin,** Asst. Engr., Dept. of Public Works, Chicago.

In spite of nine reverse bends and the use of 24-in. valves on both 30 and 36-in. pipes, the "C" value varied from 144 to 155 with an average of 148. If the friction loss in these bends is discounted, then the actual "C" value of the pipe line was 166.

At static pressure tests of 100 to 135 lb. it was indicated that the loss was but 2.74 gpd. per inch diameter per mile of pipe. Two years later the loss had not changed appreciably. The loss of head over the entire two and one-half miles of pipe was only 5 to 18 ft.

Deficiencies of Distribution Systems

"Characteristic Deficiencies of Water Distribution Systems" may fall into a variety of classes, according to **R. G. Kincaid** and **R. E. McDonnell** of Burns-McDonnell, Cons. Engrs., Kansas City, Mo. Citing the examples below to prove the point, Mr. Kincaid insisted that correction of such deficiencies should begin now. One of the most usual types of inadequacies is that brought about by the normal growth of a community and consequent inability of old lines to serve the demand. If the "C" value drops at the same time, the loss of head is even greater.

Honored
John R. Baylis
Engr.-Chemist
Bur. Engineering
Chicago

Among the "horrible examples" are the gravity system with no storage, thus overloading the supply line at peak demands. No flexibility in discharge headers, booster stations which can't meet the supply, suction and discharge lines that are overloaded, mains connecting storage to distribution system too small are other typical examples of characteristic deficiencies.

Other cases are those including storage which fails to work as intended even when on high ground, mains which are bottle necks, and round-about service to reach short distances.

Pipe Flow Formulas

Pipe has improved considerably since the first pipe flow formula was developed more than 200 years ago, but although many formulas have been proposed and used, they are all empirical and none has eliminated all the difficulties of their use. This was the opening comment of **Julian Hinds,** Gen. Mgr., The Metropolitan Water District, Los Angeles, who spoke on the "Comparison of Existing Formulas for Pipe Flows."

It is difficult to formulate a proper formula because it is impossible to measure the roughness or irregularities of the inside of the pipe. It is desirable to eliminate this difficulty, but to date it has not been done.

Among the conventional formulas for pipe flow are the Chezy, the Darcy, and the Exponential. The Manning, Hazen and Williams, Kutter, and Scobey formulas are of the latter general type.

Mr. Hinds says that there is no practical basis of choice today between the Scobey and the Hazen and Williams formula. Scobey and Manning formulas differ considerably at the larger diameters. The Scobey and Kutter formulas agree better than Scobey and Manning. When the hydraulic radius is 1 meter (3.28 ft.), the Kutter and Manning formulas agree, but at lower diameters this agreement is not so good.

To have a universal formula we must take into consideration the viscosity of the liquid. This involves the use of the Reynold's number. This equation gives one value for laminar flow and another formula for turbulent flow. These formulas are for smooth surfaces and do not fit for rough pipes.

Colebrook has the following for-

W. A. Glass
Supt.
Dept. Water & Sewage
Miami, Fla.
and
J. P. Schwada
City Engr.
Milwaukee, Wis.

C. K. Calvert
Supt. Purification
Indianapolis Water Co.
and
E. J. Umbenhauer
Supt.
Water & Sewage
El Paso, Tex.

C. M. Ledbetter
San Engr.
State Health Dept.
Jackson, Miss.
and
Baxter F. Wade
Supt. of Water
Jackson, Miss.

H. F. Blomquist
Supt. of Water
Cedar Rapids, Ia.
and
J. J. McCarthy
Chemist
Water Dept.
Racine, Wis.

C. C. Larson
Chief Chemist
Dept. Water & Swge.
Springfield, Ill.
and
J. J. Woltmann
Cons. Engineer
Bloomington, Ill.

mula which is quite similar to the Scobey formula in results.

$$\frac{1}{\sqrt{f}} = -2 \log \left(\frac{K}{3.7D} \right) + \frac{2.51}{R\sqrt{f}}$$

The older formulas are limited. The newer formulas are particularly good for laminar flow, but are not useful. The Colebrook formula for turbulent flow is theoretically correct but needs more study. Neither the Colebrook nor the Scobey formula fits field data.

Procedures for Pipe Line Flow Tests

A tentative summary of a manual of "Procedure for Flow Tests of Pipe Lines" was presented with the aid of pictures by **W. W. Wyckoff**, engineer in Charge of Aqueduct Division, Los Angeles. Controlled flow conditions are essential as is complete information on the line, gate valves, dips, etc. Exact data are needed on flow data, volumes, and either pitot tubes or manometers may be used. Mr. Wyckoff gave details of procedure and the details of equipment to be used.

Standards for Steel Pipe

"Design Standards for Steel Water Pipe" will be published in reference form according to **Russell Barnard**, Advisory Engr., Spiral Welded Pipe Dept., Amer. Rolling Mill Co., Middletown, Ohio. Among the details will be 15 photographs, 40 line drawings, and a large number of tables covering pipe sizes from 6 to 36 inches. Steel pipe may be used in supply lines, equalization lines, force mains, and well water casings.

Discharge diagrams will be given for "C" equal 150, cost of electric power for pumping at different pressures. Also included will be factors influencing pipe wall thickness.

The manual will list characteristics of four soil classifications based on air penetration. There will also be information on depth of pitting, and time curves; selections of coatings versus soil types; types of field joints; kinds of fittings; types of reinforcement for fittings; attachments for valves; threaded attachments; anchoring couplings, and supplementary information required by A.W.W.A. Specifications.

FINANCE AND ACCOUNTING DIVISION

Under the presiding gavel of **Gustav B. Schunke**, chairman of division, and Ass't Sup't Water Dep't, Seattle, Wash., the Finance and Accounting Division devoted one session to the three topics: joint administration of water and sewer accounts, meter rate structures, and nuisance charges, with eleven members taking part in the proceedings.

Distinguished Speaker
Major Gen'l L. A. Pick
Chief Engineer
Missouri River Div.
Omaha, Neb.
(Of "Pick's Pike" Fame)

Joint Water and Sewer Accounts

Leading off the panel discussion of the "Joint Administration and Collection of Water and Sewer Accounts" was **Leonard N. Thompson**, Gen. Mgr., Water Dep't, St. Paul, Minn., and chairman of the committee of that name.

Now that financing by sewer rentals appears more and more popular, Mr. Thompson says he finds that the average water works man shies away from the collection of sewer rents. Dual collection, however, is economical and needs only good practical and sound rules to overcome difficulties. Mr. Thompson gives the following rules as basic and sound.

1. Water works management should be sure that charges are adequate.
2. The idea should be created that the sewer bill is separate.
3. The charges should be simple, clear, but inconspicuous.
4. It is important that there be complete separation of the water and sewer accounts.
5. The water department should act only as the agent in the collection.
6. Penalties must be applicable to the sewer bill as well as to the water bill.
7. Decisions must be made concerning sewer users who don't use city water.
8. Billing dates for both water and sewer should be uniform.
9. The sewer department must pay the water department for out of pocket expenses in the administration and collection of the sewer accounts.
10. The actual rate structure does not matter, each department may suit its own needs.

Dr. A. E. Berry, Director, Sanitary Engineering Division, Ontario Dep't of Health, spoke on the matter of rates, first reviewing the subject of water rates. Water rates should be proper, before sewer service rates are adjusted to them. Water rates should not be based on ability to pay but on the basis of service. Water rates should be equitable—it is generally thought that water meters are the best basis for a rate structure as opposed to a flat rate structure, or fixture basis. Another basis is the value of property. In any system, one should not overlook hidden costs, which may quite generally be extensive in small communities.

Water rates must come before sewer service rates, and Dr. Berry believes that the meter is the best basis, because it relieves real estate from some of its burden. Sewer rents (preferably "sewage rates" or "sewer service rates") must have a legal basis before they can be set up. Sewage rates may be based on water consumption, or on the number of plumbing fixtures; special rates may also be developed for industry.

To determine the best system for individual communities will require a survey of the local situation.

According to **W. F. Tempest**, Portland Cement Assn., there are 200 cities that have financed sewers by

A. W. Thompson
President
Ludlow Valve Co.
and
"Bob" Bischoff
Sales Manager
Ludlow Valve Co.
Troy, N. Y.

Frank Gibson, Pres.
Lane Louisiana Co.
J. I. Seay, Pres.
Lane-Bowler Co.
Memphis, Tenn.
Lee Rogers Pres.
Layne Western Co.

Paul Weir
Asst. Gen'l Mgr.
Water Dept.
Atlanta, Ga.
and
John L. Hawkins
Supt. of Water
Greenville, S. C.

"Jimmie" Angell, Jr.
New York
Lee McMahon
Cleveland
"Larry" Lingnor
Chicago
"Water & Sewage Works"

C. E. Palmer, Pres.
Palmer Eng. Co.
Erie, Pa.
and
Fred E. Stuart, Pres.
Stuart-Brumley Corp.
Baltimore, Md.

revenue bonds, and the method is certain to become more popular. Before water utilities become involved in this type of financial planning, they should know what the system is and what it will do. For one thing, careful consideration must be given to the anticipation of revenue and how it compares with collections.

Whereas there are many water and sewage plants badly needed throughout the country, there are too many cities diverting water works funds to luxury projects (airports, recreation parks, etc.).

Not only are the facilities needed, but financing is needed, and Mr. Tempest believes that the laws governing financing also need revision. Nevertheless, municipal utilities should give consideration to revenue financing for future construction.

The paper prepared by **Hal F. Smith,** Sr. Adm. Ass't, Detroit Dep't of Water Supply, was read by **A. P. Kuranz,** Waukesha, Wisc. The paper dealt with the experiences at Detroit and may be summarized as follows: The rate is based on metered water rates, and the rate structure is on a volume basis with straight rates, not step rates.

Cheaper billing is obtained by putting both the water and sewage bill on the same invoice with both rates shown. There seem to be fewer delinquencies with this system. After six years, this system has proved to be highly satisfactory, but it is necessary that the accounts be kept separate.

Mr. Smith believes that the sewage rate should be a lien on the property if not paid. Other good methods of enforcing the charge are the turn-off of water or the turn-off of sewage. Civil suits to recover the amount of the bill are too costly.

Adjustment must be made for water not going to the sewers, and this is one of the most troublesome problems of the administration of joint accounts. This is true, from the person who does considerable sprinkling to large industries which use the water for processes or for steam production.

The adjustment rule adopted was to apply the sewage rate on the basis of water bought except for strong wastes, and on the entire amount of water used, not on what just reaches the sewer.

John W. Pray, Fort Dodge, Iowa, asked two questions—what interest may be expected on revenue bonds, and what charges for sewer service are made to outside communities?

Mr. Tempest replied to the first question saying that at the present, 4 per cent interest is generally obtainable, but as the attitude of the public changes and esteem for revenue bonds goes up, it may be expected that the return will go down.

Leonard Thompson answered the second question, saying that in St. Paul, surrounding suburban communities are charged twice the sewer service rate prevailing within the corporate limits.

Meter Rate Structures

"Most of the old 'Meter Rate Structures' were the result of cut and try procedures or depended on customer complaints," said **G. B. Schunke,** Ass't Sup't, Seattle Water Dep't. Inasmuch as costs of operation are made up of both fixed and variable factors, many persons think that a modern meter schedule should have a minimum charge and a sliding scale. Better perhaps, than a minimum charge, per se, is a ready to serve charge.

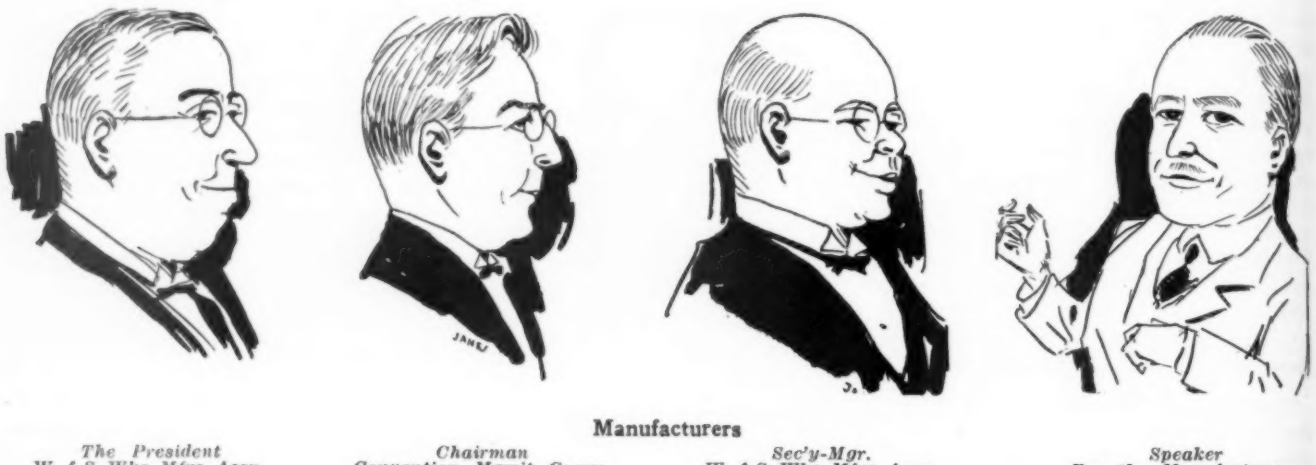
"And why must water be sold on a sliding scale," why not a straight volume charge after some minimum to take care of fixed charges. Mr. Schunke cited post office rates, railroad and freight rates, telegrams, bus fares as rates oked by law without a sliding feature. Why then must large water users be given lower rates for large volumes of water when it is that very consumption of large volumes of water which requires the installation and maintenance of a large water supply, thereby increasing the fixed costs?

The reasoning, that sliding scales bring both business and customers, is an overworked idea, according to Mr. Schunke, who presented statistics on three separate industries of widely varying characteristics and gross incomes. The data showed that because of the sliding scale the ratio of water costs to gross income was inverse although the consumption of water had a direct relation to the gross income.

Seattle has had complete metering for 30 years and until recently the rate was six cents per 100 cu. ft. Rates are now nine cents per 100 cu. ft. with industrial rates of four cents. Sewage service rates are added to the above. The ready to serve charge is $3 per year for domestic service and $6 per year for industry.

The idea of slides, which recognize the wholesale principle of encouraging greater use, needs new thinking now. This is so, says Mr. Schunke, because we now have more customers than can be served with the inadequate facilities available. Charges should be alike to all now.

Equity will best be served, according to Mr. Schunke, when (1) the ready to serve charge is based on needs, (2) consumers pay for what they use, i.e., a single rate,



Manufacturers

The President
W. & S. Wks. Mfrs. Assn.
Wm. C. Sherwood.
Hersey Mfg. Co.

Chairman
Convention Mgm't Comm.
Wm. J. Orchard
Wallace & Tiernan Co.

Sec'y-Mgr.
W. & S. Wks. Mfrs. Assn.
Arthur T. Clark
New York

Speaker
For the Manufacturers
Col. W. F. Rockwell
Rockwell Mfg. Co.

Programmers

Julian Hinds
Ch. Engr. & Gen. Mgr.
Metro. Water Dist.
Los Angeles

Vance C. Lischer
Horner & Shifrin
Cons. Engrs.
St. Louis

E. E. Easterday
Commissioner
of Water
St. Louis

S. B. Morris
Gen'l Mgr. & Ch. Engr.
Water & Power
Los Angeles

L. J. Alexander
Engineer
So. Cal. Water Co.
Los Angeles

W. W. Wycoff
Aqueduct Engr.
Dept. of Water
Los Angeles

Chas. P. Hoover
Chem. Engr.
Div. of Water
Columbus, O.

and (3) special privileges and rates are abolished.

On the question of whether the ready-to-serve charge should include a minimum use, **Charles H. Capen,** Chief Eng'r, No. Jersey District Water Supply Commission, was very definite in his discussion. Mr. Capen admits that most water works men favor a separate and distinct ready-to-serve charge, but he, himself, has altered his stand and now is in favor of a simple minimum charge. This change of heart has followed a study of consumer complaints and the ready acceptance by the consumers of a minimum charge for an allowable minimum use of 4 gallons per capita per day. Such a small volume as 200 cu. ft. per month has little effect on estimating income and such minimums are justified so long as the unaccounted-for water is 10 per cent or more of the gross output.

A minimum charge of this type can, in the opinion of Mr. Capen, be properly adjusted to cases where the consumer closes his house for the winter or the summer.

As to Mr. Schunke's comments about no minimum charge for telegrams, freight rates, etc., Mr. Capen pointed out that gas and electric bills, many telephone bills, and weekly bus or trolley passes are commonly accepted examples of the principle of minimum charges. Minimum charges are in accord with the American custom of receiving something for every dollar expended.

Mr. Capen was in outright disagreement with Mr. Schunke on the matter of one rate for water regardless of quantity used. Mr. Capen has consistently advocated that the ratio of small quantity rate to large volume rate should be between 2:1 and 3:1. This is in accord with the fact that business prosperity has been established on principle that quantity production makes for lower costs and prices.

Even postal rates, telegrams, freight rates, and other transportation rates accept this principle. The Post Office gives quantity rates on publications, telegrams cost less at night, carload freight shipments move at lower rates than less-than-car-load lots, and the round trip and commuters' reduced fares on railroads and buses are well known examples of the slide principle.

Mr. Capen, however, does not favor selling water at less than cost to anyone and is definitely against subsidies or free water to anyone. Water departments should pay for services received (rent, light, etc.) and should receive pay for services rendered (fire service, service to other municipal departments).

As to the problem of dwindling supply and insufficient facilities in comparison with growing demand, Mr. Capen sees the answer in the development of special industrial water supplies, supplies that will require little or no treatment before use. While this may solve the problem of supply it complicates the problem of cross-connections. To offset this danger, Mr. Capen proposes the maintenance of a high residual chlorine at all times in the industrial supply.

In concluding his discussion of the subject, Mr. Capen reviewed the salient points in the outstanding articles that have been published on the subject of water rates since 1907. Many of the ideas expressed are good yet today, many need revision in light of modern conditions, but the entire bibliography is worth reading by persons faced with meter problems.

The third discussor of this topic was **M. F. Hoffman,** Cincinnati, Ohio, who believes that water rates should be sufficient to cover the cost of operation, plus fixed charges and provide for such expansion as may be deemed necessary.

Many rates in the past have been set by guess and need present day scrutiny and revision. Considerations should be given to such a fact as that it costs more to supply water to 1000 meters than it does to supply the same volume to one meter.

Sliding scales are proper, providing the lowest rate is not below the cost of production. During his comments, Mr. Hoffman cited the experience of Cincinnati and Cleveland, the latter of which has a very complicated rate structure.

Harvey Jones
Cons. Engr.
Jones & Henry Engrs.
Toledo, Ohio
and
C. B. Pilcher
Commissioner
Public Properties
Ft. Dodge, Ia.

L. S. Vance
Chief Engr. & Supt.
Water Works
Louisville, Ky.
and
Ray Parkhurst
Sales Mgr.
Rennselaer Valves
Troy, N. Y.

Dr. Abel Wolman
Professor
Johns Hopkins Univ.
Baltimore, Md.
and
W. W. Horner
Cons. Engineer
St. Louis, Mo.
(President A.S.C.E.)

Geo. E. Ferguson
Distr. Engr.
U. S. Geol. Survey
Ocala, Fla.
and
Melvin P. Hatcher
Director
Water Dept.
Kansas City, Mo.

Chas. A. Haskins
Cons. Engr.
Kansas City, Mo.
and
Leonard Day
Cons. Engr.
St. Louis, Mo.
(Former Commissioner of Water, St. Louis)

Nuisance Charges

"Stop Those Nuisance Charges! Stop Those Nuisance Charges!" was the cry which rang out through Assembly Room No. 2 of the St. Louis Auditorium, when **E. E. Norman,** Manager, City Light and Water Utilities, Kalamazoo, Mich. presented one of the sparkling highlights of the Finance and Accounting Division sessions.

Mr. Norman listed twelve nuisance charges which have been discontinued in Kalamazoo and which in his opinion should be discontinued in every municipality. These include the turn-on charge, the turn-off charge, the trip charge, meter purchase, routine meter repair charges, charges for repair to meters damaged by hot water, charges for repair to frozen meters, meter tests, meter rent (not to be confused with demand charges or service charges), charges for the inspection of service installations, service connection repair charges, and the water bill as a lien against the property.

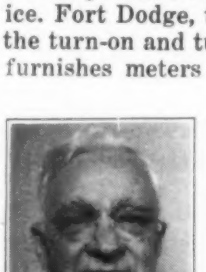
Kalamazoo has experienced no increase in delinquency with the abolishment of the turn-on charge, and the number of meters damaged by either frost or hot water has been no greater than when charges were made for such repairs. Now when meters are damaged by hot water, for example, the consumer is given a warning that a charge will be made if the damage occurs again. This is very effective. To reduce the number of frozen meters, the utility takes paid space in the local newspapers to advise the consumers to take proper steps. For this advertising, "Willing Water," the copyrighted feature of the A.W.W.A., is used.

Although no charge is made for meter tests requested by the consumer, the utility requires that the consumer must be present at the test. Of course, no such requirement is made for the regular testing done in the course of routine testing operations. This system reduces the number of extraneous tests requested and is highly satisfactory.

Consumers must install their own services in Kalamazoo, but the utility inspects them free of charge. The utility also makes all repairs on the water service lines, because the water in the line is public although the line is on private property. This method has resulted in fewer leaks on service lines and more rapid repairs than has the old method of requiring the consumer to repair leaks at his own cost.

Although the water bill is not a lien on the property in case of non-payment, the utility does require deposits where non-payment has occurred, but this has generally not amounted to more than $250 a year, total, and on this the utility pays a three per cent interest.

First to discuss the subject of nuisance charges, **John W. Pray,** Manager, Municipal Utilities, Fort Dodge, Iowa, said that in the past several years he had become more and more liberal minded toward the consumer. Pray believes in rendering the best possible service at the lowest possible charge for that service. Fort Dodge, too, has eliminated the turn-on and turn-off charge, and furnishes meters as well as making



Distinguished Visitors

From Hawaii
Fred Ohrt
Genl. Mgr.
Bd. Water Supply
Honolulu

From Russia
M. N. Shestakov
Chief Engr.
Water & Sewage
Moscow

repairs except where such repairs are occasioned by negligence.

No meter rent is charged, and even hot water damage to meters is repaired free of charge on the first offense. Fort Dodge makes no charge for inspection of service installations although the consumer has to install the service. The water bill is not a lien against the property in Fort Dodge, and yet there is small loss from delinquent accounts. "All in all," said Mr. Pray, "our rates are comparatively low and still we have no service charges."

Celebrating his 31st anniversary in water works service, **Roger Esty,** Sup't of Water and Sewage Works, Danvers, Mass., recalled that the first experience he had with nuisance charges was a summons charge of 25 cents for delinquent bills. After a rather harrowing experience with one of the town's leading lights on that charge, Mr. Esty was an easy convert to the abolishment of nuisance charges and he has been ever since. Danvers owns all of its meters, and repairs them free of charge except for a second damage by frost or hot water.

The city of Danvers makes a service charge on installations, and does use the lien law of Massachusetts, but has little difficulty from either of these practices. In order to simplify the problem of non-payment of water bills, the utility does business only with the property owner, who in turn must collect from the tenant.

In the matter of public relations and complaints against high water bills, Mr. Esty has found the Meter Master to be invaluable in analyzing the water consumption of persons who cannot understand why their water bills should be high when the folks next door have a low water bill. The Meter Master also helps to locate leaks within the consumer's property.

C. M. Roos, Manager, East St. Louis & Interurban Water Co., concluded the discussion of the topic, pointing out that the revenue derived from nuisance charges is extremely small compared to the gross revenue. Its value becomes even smaller when compared to the loss of customer good will. A study of some 46 plants indicated that not too many plants use these charges any more. A few have turn-on charges, several have charges for repairing frozen or hot water damaged meters, and some have service charges for installation. The general trend, however, is definitely away from the use of these nuisance charges in any form.

WATERSHED CONTROL AND EROSION PREVENTION

*Reported by Harry A. Faber**

For the past year an A.W.W.A. Committee on Watershed Control has been in the process of organization under the chairmanship of **Earnest Boyce,** Professor of Municipal and Sanitary Engineering at the University of Michigan. Professor Boyce outlined the scope and activities of the program set up by the committee, noting that an analysis of the information already available on this subject will advance its work considerably.

Watershed control is economically justifiable, serving either as an integral part of water quality protection or of the purification process, and the committee is to evaluate specifications and procedures in order to make recommendations. In addition, a better understanding of erosion control is needed; suitable

*Research Chemist, The Chlorine Institute, and Editorial Associate, *Water & Sewage Works.*

Robt. S. Millar
Manager
Wich. Water Co.
Wichita, Kan.

L. E. Livingston
Mfrs. Agent
Dallas, Tex.

A. F. Porzelius
Manager
City Water Co.
Chattanooga, Tenn.

Reeves Newsom
Village Manager
Scarsdale, N. Y.

John Winder
Chief Engr.
Water & Sewage
Dallas, Tex.

P. N. Engle
President
Infilco
Chicago

Hubert O'Brien
President
A. P. Smith Co.
E. Orange, N. J.

regulations must be devised, and the economic justification of this phase must be developed. It is apparent that the practical cooperation of A.W.W.A. members can do much to further the progress of this committee.

Influence of Forestation On Watersheds

Edward E. Minor, Vice-president of the New Haven (Conn.) Water Co., discussed "The Influences of Forestation on Reservoir Watersheds." Interest in forestation has developed largely within the past fifty years—since the myth has been exploded that ample virgin timber will always be available. The purchase of large land areas is frequently necessary in order to protect water supplies and, in line with enlightened State, Federal, and industrial policies of reforestation, a definite policy of silviculture should be established by water utilities. The experience of specialists in this field is required, not only to protect water supplies, but to realize a financial return. Mr. Minor cited the profitable experience of his company with 25,000 acres of land which has been planned and planted overall with trained supervision.

The technical aspects of this topic were discussed by **E. N. Munns,** Chief, Division of Forest Influences, Forest Services, Washington, D.C. Mr. Munns described the characteristics of various trees which determine their selection for specific purposes; when related to the water supply problem, forests can affect the yield, the seasonal runoff, and the water quality. Suitable plantings may be made primarily as a protective cover to increase soil stability, with added value from the increase in water holding capacity, and thus show a profitable return on the investment. The Forest Service has not only studied the basic factors concerned, but now has under way studies which are directly applicable to water supplies. The development of future research is planned to be in cooperation with this committee of the A.W.W.A.

John S. Longwell, Chief Engr. and Genl. Mgr., East Bay Munic. Utility Dist., Oakland, Calif., discussed the progress made in review of the literature on this phase of the subject, with special reference to the helpfulness of the U.S. Soil Conservation Service. Prior to the war, this service cooperated in a program which Mr. Longwell planned for 86 square miles of watershed. The program was well under way and provided definite evidence that silting could be greatly reduced, thus saving valuable water storage area. The committee plans to collect basic data on factors involved in erosion and to study programs already under way.

Erosion Control

That many such programs of erosion study have been interrupted by the war was also pointed out by **C. B. Brown,** Head of Sedimentation Section, Soil Conservation Service, Silver Springs, Md. It has been well established that the loss of reservoir area through erosion and silting represents a critical condition which will necessitate large scale replacement and enlargement during the next few years.

Examples of municipalities already faced by this problem were cited and Mr. Brown described the means by which it could be solved. Of the one billion acres of farm land available in the U.S. more than 90 per cent is in need of erosion control measures, but little more than 10 per cent has been adequately treated to date. Soil conservation districts, now being widely established, provide one practical means of protecting large watersheds which are not under the ownership of the water utility. Where erosion problems are especially severe, the purchase of land may be necessary and the soil conservation authorities will be found most willing to cooperate in planned programs.

WELLS AND PUMPS

A Panel Discussion

*Reported by Harry A. Faber**

Public Use of Reservoir Lands and Waters

Speaking on the topic "Public Use of Reservoir Lands and Waters," **Lewis S. Finch,** Chief Eng'r, Indianapolis Water Co., Indianapolis, Ind., said that no universally applicable

*Research Chemist, The Chlorine Institute, and Editorial Associate, *Water & Sewage Works.*

Richard Ellis
Engineer
F. M. Fire Ins. Co.
Boston
and
S. P. Carman
Ch. Engr. & Supt.
Water Bureau
Binghamton, N. Y.

E. C. Goehring
Asst. Mgr.
Munic. Water Authority
Beaver Falls, Pa.
and
Lloyd McCoy
Diamond Alkali
Pittsburgh, Pa.

"Reg" Hayes
Sales Manager
"Hydrotite"
New York
and
"Ernie" Meyer
Supt.
Water Commission
Glen Falls, N. Y.

Chas. H. Bagwell
Supt.
Meter Dept.
Knoxville, Tenn.
and
John J. Quinn
Supt.
Water Purification
Knoxville, Tenn.

Jos. W. Kelley
"Cardox"
Corporation
Chicago
and
A. H. Ullrich
Supt.
Water Purification
Ft. Smith, Ark.

rules can be established but that general principles can be agreed upon. The problem involves management as well as engineering. His discussion involved an attempt to rationalize the wide differences of opinion and viewpoint. What is the effect on the operation of the water works?—on community benefits?—on the cost to the utility? Fishing, boating, and picnicking would not generally constitute a hazard to water quality, but bathing usually would be at least psychologically objectionable. The use of reservoir property would frequently be found a contribution to the good will of customers, nevertheless, the cost involved should not be greater than the amount properly chargeable to good will. The safety of the water supply should be of primary importance, especially where no filtration is provided, and then public use should be determined on the basis of local conditions.

At one afternoon session, devoted to water wells and deep well pumps **S. F. Newkirk, Jr.**, Eng'r and Sup't, Bd. Water Comm., Elizabeth, N.J., acted as chairman and introduced as leader of a panel discussion **J. C. Harding**, Consulting Engineer, Mt. Kisco, N.Y., and 1945 Diven Medallist of A.W.W.A. Mr. Harding guided the discussion of "The Useful Life of Water Wells," in which six experienced water works men presented their opinions and experiences.

E. W. Bennison, Office Engineer of Edw. E. Johnson, Inc., St. Paul, Minn., opened the discussion by reviewing the many factors which must be considered in order to answer this question. Important are: The consideration of water bearing formations available, the withdrawal and the replenishment, the type of well best suited to the purpose; the materials of construction; the methods of construction; and the development of the underground area. Average life of all wells seems to be 25 to 50 years, and oldest of all are generally screened rock wells; with proper attention to all factors, there is no reason why the life of rock wells should not be double the average figure.

Angus Henderson, Civil Engineer, Bayside, N.Y., based his discussion on the extensive system of wells which constitute a part of the water system of New York City. A recent survey of these, mostly only 20 years old, showed only two wells to be operating over 75 per cent of capacity. It is now considered good practice to place a 2 inch cement casing around the metal pipe. Redevelopment of wells, while frequently made necessary by incrustation, is always attended by risk of damage. Few wells fail in less than ten years, but the half life generally averages only fifteen years.

J. B. Millis, Eng'r, Illinois State Water Survey, Chicago, Ill., cited a study of various types of wells selected from the total of over 200,000 wells recorded in that state. The average life of 79 wells in deep sandstone was found to be 27 years. The records of 83 municipal limestone wells show an average life of 29 years. Of 320 municipal sand and gravel wells, having an average life of 6 years, some 80 per cent were abandoned (only 35 were still in service). Chemical, bacterial, and mechanical causes of corrosion or clogging were discussed.

A. E. Berry
Secretary
Canadian Section
Toronto
(Elected President Fuller Award Soc.)

J. A. Carr, Sup't. of Water, Ridgewood, N.J., described failures as due in many instances to inadequate knowledge or faulty evaluation of test data. Experience in the shale and sandstone formation of northern New Jersey has established the practical impossibility of driving casing to make tight seals. Pollution is frequently the first evidence that the seal has not been successfully maintained. Cleaning by brushing and surging frequently gives a permanent increase in capacity, whereas blasting often has a detrimental effect.

L. A. Smith, Supt. of Water, Madison, Wisc., stressed the effect of inadequate diameter on the life of rock wells drilled in sandstone. With proper attention to good practice, it appears that wells could have a useful life of more than 50 years. Overpumping is an important factor, indeed, but is difficult to evaluate. Well construction and operation records are likewise important.

Deep Well Pumps

A comprehensive paper discussing the "Purchase and Maintenance of Deep Well Pumps" was presented by **Louis J. Alexander**, Design Engineer, Southern California Water Co., Los Angeles, Calif. This company has in use about 107 deep well turbine pumps operating from the hot desert to snow clad mountains, from sea level to 7,000 feet elevation, and delivering from 100 to 2,200 gpm. Standardized specifications are well established so that pumps can be shifted from one location to another. Soil formations are generally so unstable that the infiltration of sand cannot be prevented. Check valves are used in the casing above pump bowls, and bronze impellers have been found most satisfactory for this service.

Mr. Alexander noted that so-called iron and sulfur organisms, and free hydrogen sulfide gas contribute most seriously to difficult operating conditions. Corrosion due to these factors and to turbulence has again best been resisted by bronze. All equipment is placed in operation at least once each week, starting and stopping automatically in response to demand. Daily checks are made by plant operators and monthly surveys by field engineers.

The company has established a 2, 3, 4, or 5 year schedule of pump reconditioning, as determined by the type of water characteristics encountered. The extent of pump and motor overhaul given was described; two to three days of 24 hours are usually required to remove, recondition, and reinstall a pump. Equipment is purchased *only* from those manufacturers prepared to render immediate repair service. The pump supplier is required to guarantee efficiencies of pump, motor, and the complete unit.

In a prepared discussion of this paper, **T. E. Larson,** Chemist, Illinois State Water Survey, Urbana, Ill., commented particularly on four specific factors affecting pump corrosion: galvanic action within pump itself; waterline corrosion on outside of column pipe; corrosion caused by carbon dioxide in high pressure areas and accelerated by hydrogen sulfide; and stray electric currents. To check such corrosion cathodic protection devices have been installed, but not yet evaluated.

Mr. Alexander, replying to a question, said that all pumps discussed were of the oil lubricated type since none of the water lubricated pumps now obtainable meet the company's specifications.

SCREEN CLOGGING BY A RARE SPECIES OF ALGAE

By W. W. DE BERARD and JOHN R. BAYLIS
City Engineer Engr., Water Purification
CHICAGO, ILL.

On several occasions since 1935 there has been screen clogging trouble in the fall of the year at the water intake cribs and pumping stations of Chicago's water system caused by Dichotomosiphon tuberosus. The clogging was particularly heavy last year at the South District Filtration Plant, recently placed in partial service.

This is a rare species of algae belonging to the chlorophyceae group. Smith (*Fresh-Water Algae of the United States*) states: "The thallus of Dichotomosiphon is a dichotomously branched tubular coenocyte transversely constricted at each dichotomy. There are often additional constrictions between successive forking of the thallus." A photomicrograph of this organism (Fig. 2) is shown. Note the branching of the thallus or filaments giving the dichotomo—(meaning equal branching) prefix to the name of this species. The siphonales are extremely varied as to size and external form but are alike in that the entire plant body is a single cell with many nuclei.

Screen clogging at the filtration plant was first noted on October 19, 1945, and was quite severe for about ten days. In addition to trouble at the filtration plant there was screen clogging at the various pumping stations, starting in September in the north side stations. Some algae were noted on the screens at later dates at the filtration plant, but not enough to cause trouble. One characteristic of the material found on the screens was its toughness. Some of the fibers were two to three inches in length.

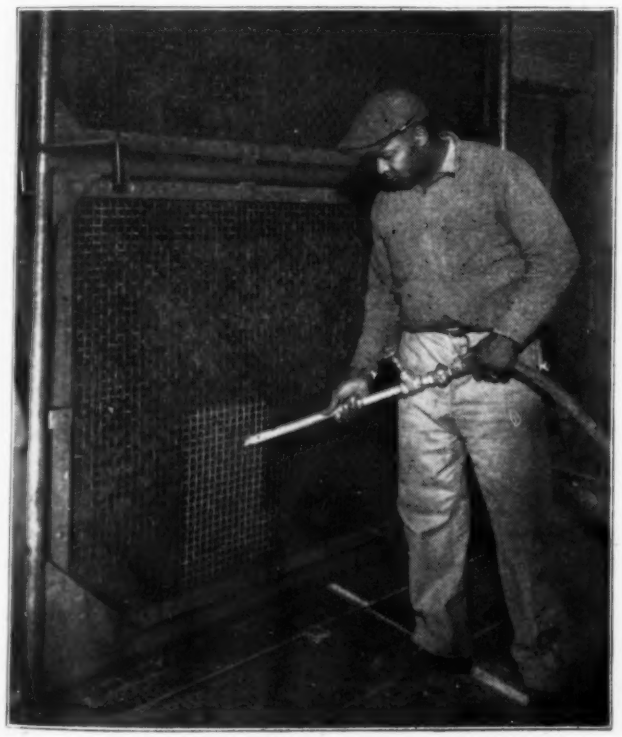


Fig. 1—Removing Dichotomosiphon Deposit from Intake Screens With Air-Jet.

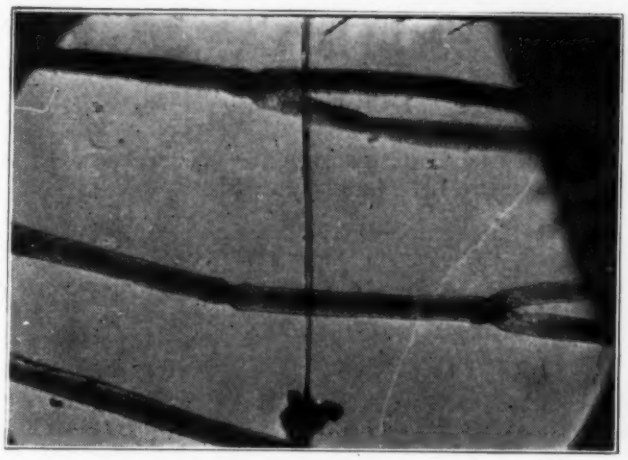


Fig. 2—Dichotomosiphon Tuberosus.
(Photomicrograph of 50 diam. magnification.)

The screen area at the filtration plant is about 3,000 sq. ft., which is a large area even for pumpage of 350 million gallons daily. The openings in the screens are ⅞ inch, quite large for clogging trouble. As soon as the clogging was noticed, the screens were raised, one at at time, and the algae removed. After trying several means of removing the matter, the most effective was found to be by use of compressed air, blowing the air in the reverse direction of the water flow. A photograph (Fig. 1) shows one of the screens being cleaned with air. Although effective in removing the material from the screen, the air scattered it over a considerable area of the floor. A shield was placed back of the screen to prevent the algae from being blown against the wall of the building. In this way the cleaning up of the premises was largely a job of washing the floor. Clearing the thirty-three screens required 24 to 48 hours. During the period of highest clogging rate, by the time all of the screens were gone over, it was almost time to start on them again.

The following is from the 1935 Annual Report of the Department of Public Works:

"During the first two weeks, in October, considerable trouble was experienced at the pumping stations supplied from the Dunne, Four Mile and Harrison crib intakes with an unusual type of green filamentous algae growth, which collected on the fish screens forming a heavy mat which was very difficult to remove. The growth had a high ash content and therefore could not be burned off the screens. It was found that the best method to remove the organisms was to raise the screens and allow them to dry, after which they could be removed by the use of wire brushes. The appearance and texture of the mat formed on the screens was similar to that of coarse burlap. The water from the Dunne crib intake was the most seriously affected. The condition was most serious on October 9th at the Western Avenue Pumping Station.

"The plant growth was identified . . . as Dichotomosiphon tuberosus, a rare type of algae belonging

to the Chlorophyceae group, whose normal habitat is in deep water. This is the first time in the memory of the older employees of the pumping stations that such accumulations occurred on the screens at the stations. There is reference, however, to this organism in the 1878 annual report of the Department of Public Works, which states that a similar type of algae was found in a microscopical examination of the lake water by Prof. A. S. Bastin."

The following is from the 1936 Annual Report:

"During the month of July there was a recurrence of trouble, due to the matting of the fish screens by Dichotomosiphon at the south side pumping stations similar to that which occurred in October, 1935. This condition also occurred at the Central Park pumping station in August."

Reference again is made to the occurrence of this organism in the 1937 Annual Report:

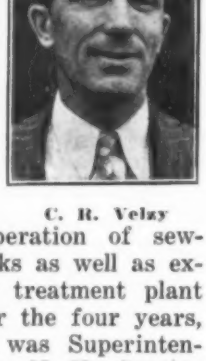
"Much trouble was experienced during the latter part of September, due to matting of the newly installed fish screens at Dunne crib intake by Dichotomosiphon."

The 1939 Annual Report also refers to screen clogging by these algae.

Clogging of screens by floating algae is of rare occurrence in the Great Lakes water. The algae are believed to grow on the bottom of the lake in deep water far enough from shore for the water to remain clear enough for sunlight to penetrate the lake bottom. The sudden appearance of the filaments in the water in the fall probably is the breaking up of the growths caused by lessening of the sunlight as the days become shorter. The rapidity with which screen clogging takes place is amazing, and requires those on duty in pumping stations (also other places where screens are used) to be constantly on the alert.

Velzy to Join Buck, Seifert, and Jost

On July 1, Charles R. Velzy will become associated with the consulting engineering firm of Buck, Seifert and Jost of New York City. In his new position Mr. Velzy will have charge of sewage works design and supervision of construction.



C. R. Velzy

Mr. Velzy brings to his new association a wealth of experience in the field of design and operation of sewage treatment works as well as experience in water treatment plant design. Except for the four years, 1938-42, when he was Superintendent of the Buffalo, N. Y., Sewage Treatment Works, Mr. Velzy has been associated since 1920 with Greeley and Hansen, Consulting Engineers of Chicago. While with that firm Mr. Velzy had charge of the construction of the Grand Rapids, Mich., plant, the aeration plant of the Wards Island Treatment Works in New York, and was resident engineer in charge of construction of the Buffalo, N. Y., treatment works, from which position he was appointed by the Buffalo Sewer Authority to have charge of the operation of the treatment works of that city.

During 1941-42 Mr. Velzy was consultant to the Constructing Quartermasters Corps of the U. S. Army Engineers on sewage and sewage disposal plant design for military posts throughout the United States. In that capacity Mr. Velzy designed the sewage treatment plant for the Pentagon Building in Washington. Since that time he has been in charge of the New York office of Greeley and Hansen.

A graduate of the University of Illinois in 1914, Mr. Velzy has been active in the Central States Sewage Works Association, and since coming east has been President of the N. Y. State Sewage Works Association. He is also a member of ASCE and AWWA. He has published papers on the Buffalo treatment works, public relations in sewage plants, gas engine operation, and sludge disposal. During the past year he has been lecturing on hydraulics and water and sewage treatment works design at Cooper Union in New York City. Mr. Velzy's immediate work with Buck, Seifert and Jost will be concerned with sewage treatment plants at Norfolk, Va., and Puerto Rico.

Third Hydraulics Conference

The Third Hydraulics Conference of the Iowa Institute of Hydraulic Research was held on June 10-12, 1946, at the State University of Iowa, Iowa City. Four years have elapsed since the Iowa Institute held the second in its series of hydraulics conferences, but now that the war is over these conferences are being resumed.

The Institute chose as the theme of its Third Hydraulics Conference the application of wartime experience, as was developed in the Office of Scientific Research Development, to peacetime phases of hydraulic engineering.

Among the topics discussed at the conference were The Role of Air-Flow Phenomena in Hydraulics, Recent Developments in Methods of Measurement, Advancements in the Study of Underwater Phenomena, Present-Day Problems in River Hydraulics, Hydraulic Transmission of Power, and Investigations of Free-Surface Phenomena.

Papers of the Third Conference will be published by the Institute and thus will become available to those requesting copies of the proceedings.

Two Misplaced Decimal Points!

(Both in Our May Issue)

On page 186 of our May issue in the article on "The Use of Lime to Eliminate Small Mud Balls in Filters," by A. E. Clark, the last paragraph read, "The quantity of lime used has averaged .045 gpg. and its use has certainly been beneficial."

Mr. Clark points out in a letter that while the use of lime certainly has been beneficial, "The quantity of lime used has averaged 0.45 gpg., *not* 0.045 gpg." This misplaced decimal would be entirely misleading to any one else trying the treatment and doubtless the smaller quantity of lime would yield very disappointing results.

And, sad to relate, on page 188 of the same issue in the first of Dr. Eglof's series on the "Survey of Elementary Mathematics" there is another misplaced decimal. In the section on Problems in Percentage, the fourth problem (second from bottom of middle column) needs a correction of decimal point in the example, to wit:

$$3.75 \times 0.70 = \text{lb. available chlorine} = 2.63 \text{ lb.}^*$$

$$\frac{3.75 \times 0.70}{30 \times 8.34} = \frac{2.63}{250} = 0.0105$$

$$100 \times 0.0105 = 1.05\%$$

*In the article this figure appears as only 0.263 lb. The strength of the solution (1.05% available chlorine, as above was correctly given.)

A NEW CONCEPT OF COAGULATION

By HAROLD R. HAY
Chemical Department
PHILADELPHIA QUARTZ COMPANY

A MILESTONE in water treatment theory was established twenty-five years ago when colloid chemistry was first seriously considered in relation to floc formation in water and sewage treatment. Those who introduced this innovation in thought used the colloidal explanation to elaborate upon, rather than to create any doubts about the then current explanation of floc formation. It may have been unfortunate for the advancement of coagulation practices that the new information obtained through colloid chemistry was not used to re-interpret coagulation theory. Perhaps the old concepts are deserving of some of Shakespeare's "modest doubt."

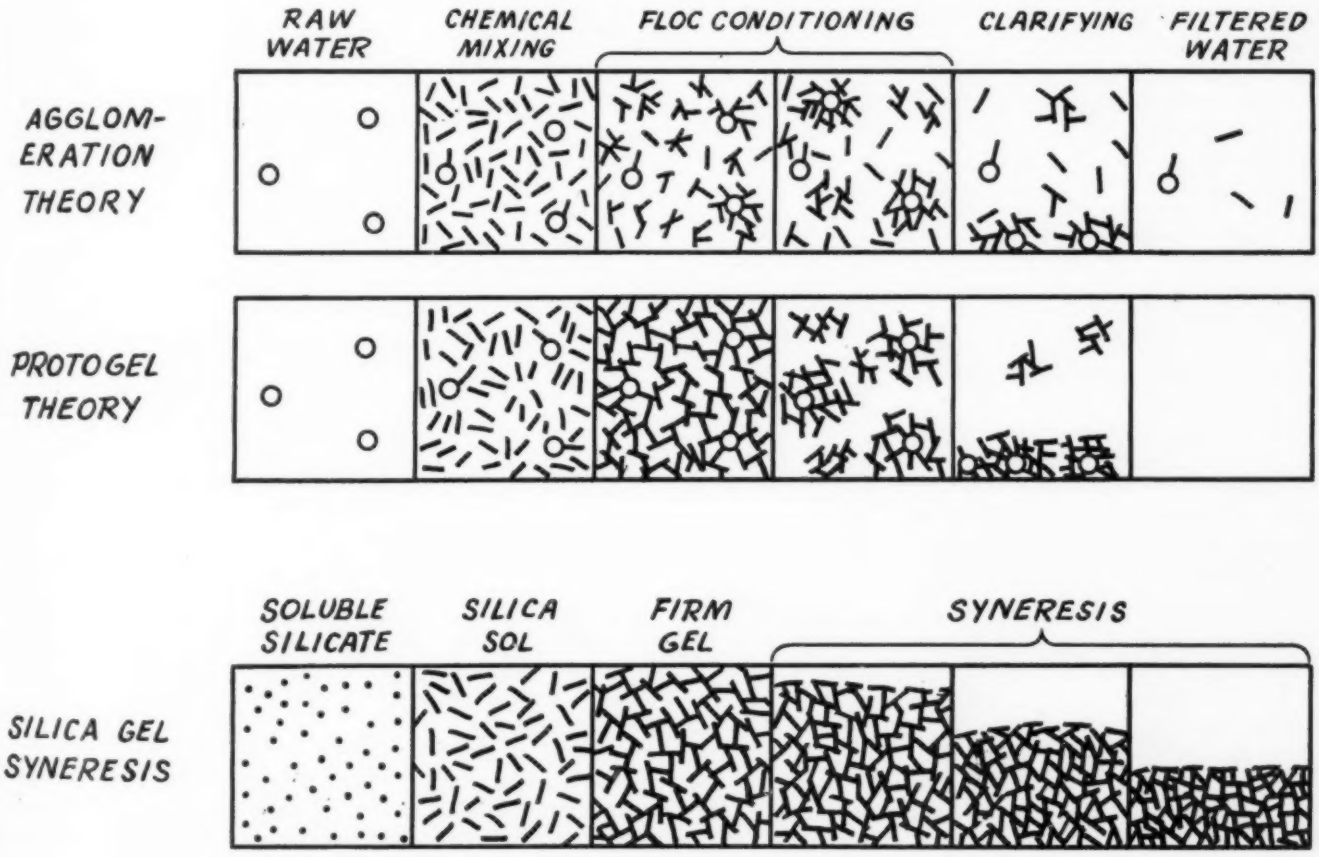
The Author

The Agglomeration Theory

The currently accepted agglomeration theory of coagulation is represented at the top of the accompanying figure. Impurities are depicted as circles, with the added alum, or rather its hydrolysis product, indicated as a straight line. In brief, it includes the dissolving of the coagulant, the formation of colloidal particles and the agglomeration of these into flocs which continue to increase in size, because of mechanically induced collisions, until the flocs are large enough to settle and leave clear water. L. H. Enslow, Editor of *Water and Sewage Works*, has likened these dispersions to humidity, fog, mist, and rain.

The agglomeration theory further envisages the removal of impurities by chemical reaction with the ionized coagulant by adsorption on the colloidal particles and by entrapment in colliding or settling flocs. Its major emphasis is on a *growing* floc. In the later stages of floc formation this is easily verified. But the "sweeping" action of a relatively large forming or settling floc may not be the major factor in clarification even when aided by the attraction of particles of unlike electrical charges. Clarification seems to occur while the particles are more highly dispersed. Apparently, to understand that which is mist, it is necessary to look deeper into the fog.

Observing the transition from the colloidally dispersed state to the first evidence of floc formation and the progressive visible growth, one is impressed by the speed with which the colloidal condition "breaks" and by the clarity of the water between



Graphic Representation of Agglomeration and Protogel Theories of Coagulation Compared to Syneresis of Gels

the flocs. This would not be expected from the agglomeration theory which, *per se*, is based upon a gradual diminution of concentration of colloidal particles. In a system of diminishing concentration, infinite time would be required for all particles to collide. In actual operation, a substantial percentage of them would never collide and would pass through the filter.

With the collision theory, and with favorable conditions for floc formation, an increase in coagulant concentration would lengthen the time for clarification rather than decrease it. There would be no critical concentration of coagulant. Also, fully as good coagulation would be expected from a divided coagulant feed as from a single addition of equal total amount. Observations contrary to these assumptions have been made. Split treatment is sometimes employed, but the dosages are either in rapid sequence or they may constitute a waste of chemical, when compared with results obtained through a single addition which has been benefited by more favorable conditioning and floc strength.

In the agglomeration theory there is no emphasis on the importance of the flash mixing of chemicals nor is there a disavowal that a long period of conditioning at very low velocity is the equivalent of higher velocity for a shorter period. A new theory can be advanced which, at present, appears to be more in conformity with observed facts and proved practices.

Proposed Protogel Theory

Consideration should be given to the readily observable phenomenon of silica gel syneresis pictured at the bottom of the accompanying figure. Sodium silicates can be dispersed in water, then by neutralization or reaction comparable to the preparation of activated silica for coagulation, the silica can be released and allowed to develop into particles of colloidal dimensions. At certain concentrations of silica, this growth continues until a firm gel is produced. Next, with allowance for time, it is seen that clear and apparently colloid-free water exudes upon the gel surface much as in the manner of perspiration. Finally, shrinkage of the gel is noted and increasing volumes of water are separated. This phenomenon of gel syneresis is the basis of a new "protogel" theory of coagulation.

The proposed "protogel" theory does not depart in any manner from the colloidal chemical features of the agglomeration theory. It interposes one more physical phase. It is suggested that after the colloidal particles have developed sufficient size, they either interlock physically or approach each other so closely that fields of force are interactive. This occurs at concentrations and shear values too low to allow use of the term, gel formation; hence the designation, protogel, signifying the lowest in a series of gel structures.

The effect of an interlocking of colloidal particles would be to enmesh all foreign matter. Subsequently, aided by mechanical agitation and, perhaps, continuing physical-chemical reactions, a shrinkage of the very weak protogel would result in disintegration and the formation of small flocs. With this shrinkage, each floc would become increasingly visible and stronger. The agglomeration theory acknowledges a visible floc to be a gel structure. In the next phase, collisions result in larger flocs. Their settling would be aided by continued shrinkage and the accompanying increase of apparent density.

According to the protogel concept, the whole of the water would have been, at one time, within the protogel structure and would have had to pass through its pores or capillaries. Such ultrafiltration might readily account for the sparkling water observed between forming flocs, and for the quality of the finished product. The entrapment of micro-organisms in the floc can also be better explained by a shrinking structure than by one forming loosely through collisions.

Effect of Mixing on Floc Formation

Flash mixing is essential to assure the uniform distribution of chemical and the formation of an all-inclusive protogel. Separately formed gels, resulting from inadequate chemical dispersion, would not clarify that portion of the water which never has been within their structures. High velocity conditioning is preferable in order to break up this protogel and to aid its syneresis.

If the function of mechanical agitation is not exclusively to promote collisions, there must be another purpose. To understand this, one must appreciate the point of view held by most scientists that gels are particles interlocked in random formation similar to a loosely piled brush heap. Such a brush heap structure is susceptible to having its volume reduced by applied pressure. Though it is not generally so recognized, the floc is subjected to pressure differentials during vertical or horizontal movement. Perhaps in the absence of turbulence these pressures would not be too significant, but neither would there be good floc formation. Small as the pressure effects may be, they are probably of utmost importance for a structure as loosely formed as floc, the fragility of which is, at times, all too evident.

Proper conditioning of a floc appears to depend upon floc toughness. Recent studies indicate that if toughness would permit, it might be preferable to provide highest velocity in the last stage of conditioning. It is desirable to toughen the floc by chemical adjustments. (In a succeeding article, the protogel concept and the considerations of floc toughness are discussed in relation to coagulation at low temperatures.)

Experimental Evaluation of Protogel Theory Needed

It is acknowledged that data are needed to properly evaluate the protogel theory. As with all theories it should be subjected to every doubt that can be advanced. The most obvious criticism exists in the question of whether a protogel, especially one of sufficiently small pore size and of adequate strength to act as an ultrafilter under conditions of turbulence, could be formed at the low chemical concentrations encountered in water clarification. Unfortunately, the writer has not been able to find scientific data which would prove or disprove this point. It would seem to require no more imagination to conceive that this could be so than it does to justify certain phases of the agglomeration theory.

Presentation of the protogel concept has been encouraged by many who hope for an ingression of ideas and for further experimentation in the principles of coagulation.

Thirty-Eighth Annual Meeting of INDIANA Section AWWA

Wilbur Shaw of Indianapolis Speedway Fame and "Golden Mittens Tournament" Are Featured at Purdue

Chairmen

Incoming
Thos. J. Burrin
Supt. of Water
Lebanon

Outgoing
Jos. L. Quinn
Hulman & Co.
Terre Haute

WITH papers on management, public health, flood control, distribution, water quality, and conversion problems the 224 registered attendants had plenty to interest them at the 38th annual meeting of the Indiana Section of AWWA on April 2-3 at Purdue University, Lafayette, Ind. In addition there was the thrilling story told by Wilbur Shaw, about a "busy day at Indianapolis" and for laughs there was the first "Golden Mittens" Tournament.

Business Meeting

At the business session, the assembled members of the section passed several resolutions including one asking that the U. S. Geological Survey cooperate with the State of Indiana in a program to complete topographic mapping of the State within the next ten years. The meeting also resolved that the Federal Government should be asked to bear the expense of moving pipe lines where such translocation is necessitated by flood control dams, just as the government is paying for the expense of moving bridges and roads which have to be moved for the same reason.

Officers elected for the ensuing year include the following:

Chairman
Thomas J. Burrin,
Supt. of Water,
Lebanon, Ind.

Vice Chairman
Ralph B. Wiley,
Head of Civil Engr. School,
Purdue University.

Secretary
Chas. H. Bechert,
Director of Water Resources,
Ind. State Dept. of Conservation.

Asst. Secretary
Wm. Firth,
Supt. of Water,
Hammond, Ind.

AWWA Director
Blucher A. Poole,
Director, Div. Envir. Sanit.,
Indiana Dept. of Health.

Honors and Awards

At the annual banquet two awards were announced. The George

AWWA

President
L. N. Thompson
Supt. of Water
St. Paul, Minn.

Secretary
H. E. Jordan
New York City
(Honored)

Warren Fuller Award was made to Joseph L. Quinn "for his foresight and untiring efforts in having prepared and published the monograph, 'Water and Sewerage Systems in Indiana,' and because of the great value of his work in planning post-war water works improvements."

The other award made by the Indiana State Department of Health was the John N. Hurty Award, presented in honor of the late crusader, Dr. Hurty, long time Indiana Commissioner of Health. This award is made to water works operators who have served for twenty-five years or more, and in this particular case was made to Harry E. Jordan, Secretary of AWWA and former Supt. of Purification, Indianapolis Water Co. as well as a past president of AWWA and Diven Medalist. The citation read "for forty-two years' service to the water works profession."

After these presentations, Leonard Thompson, President of AWWA and Supt. of Water at St. Paul, Minn., spoke of the need for increasing the membership of AWWA in the grass roots and the need for a program of better public understanding. The public relations committee of AWWA is tackling the latter problem.

Reconversion Problems

"Conversion Period Problems" was the subject discussed by **Harry E. Jordan,** Secretary of AWWA, and the main theme of his talk revolved around the Wyatt Housing Program. Briefly reviewing the pertinent facts in the housing shortage, Mr. Jordan said, "There are 29.5 million housing units in urban areas and 6.5 million units on farms. Of these, 16 million units are rentals of which 55 per cent rent for less than $30 a month. Four million of these housing units are not worth living in and not worth repairing while 6.5 million of the urban units are badly in need of repair. Considering that for the past five years the building of new units has lagged far behind the normal construction rate, it is not surprising now that there is a deficit of 8 million houses."

The housing deficit is not really new, but it is greatly increased because of this lack of building during the war. To provide for normal and past due repair and new building, we need 2 million houses built each year for the next ten years. One of the problems to be con-

Programmers

Col. D. B. Talley
Dist. Engr.
U. S. Engineers
Louisville, Ky.

Thos. F. Wolfe
Engineer
C.I. Pipe Res. Assn.
Chicago, Ill.

fronted is the high land value and the low rental value of the houses. Indianapolis has attacked this problem by buying up blighted areas of high value and building low cost housing thereon.

Vice Chairman
R. B. Wiley
Head, School of Civ. Engr.
Purdue

AWWA Director
B. A. Poole
Dir., Bur. Sanit.
Indiana Dept. of Health

Actually the Wyatt program is not an inflated program compared to long term needs, but the shortage of materials accentuates the problem. This is a temporary condition which stymies construction at the present. In order to meet the Wyatt program, water works utilities will have to build at three times the normal rate of construction. At the same time, we find that delivery of materials takes from six weeks to one year because manufacturers have no inventory. The solution is not apparent and may not be even when Congress has finally disposed of both the Wyatt program and the OPA legislation.

MANAGEMENT

In welcoming the 38th annual meeting of the Indiana Section to Purdue, **Prof. Ralph B. Wiley,** Head of the School of Civil Engineering and Engineering Mechanics, explained some of the problems brought to the University with the return of the GI's. Prof. Wiley also outlined the program of research being carried on at Purdue on industrial waste treatment and ground water recharge as well as other phases of sanitary engineering.

The first session of the meeting was devoted to management and was presided over by **Joseph L. Quinn, Jr.,** of Hulman and Co., Terre Haute, Ind. Mr. Quinn, former acting director of the Bureau of Environmental Sanitation of the Indiana State Dept. of Health was the 1945 chairman of the Indiana Section.

Pension Plan

According to **Ross Teckmeyer,** Exec. Secy. of Public Employees Retirement Fund of Indiana, the Attorney General of the State of Indiana has ruled that employees of a water department operated by a board of trustees are eligible for pensions under the "Indiana Pension Plan for State and Municipal Employees."

Mr. Teckmeyer, who believes that public employees are entitled to security, said that Indiana has had a most liberal retirement system since 1923. It costs the employee nothing for prior service annuity, and but 5 per cent of his income after the fund becomes applicable in his community.

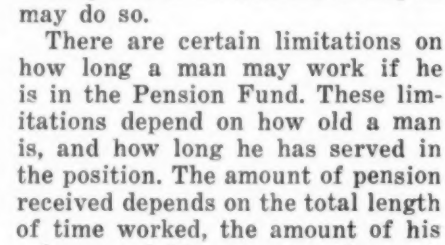
Any board of commissioners can request the Plan to make a survey of the employees under its jurisdiction, but to make the system work practically, information is needed on all employees. A municipality can drop out of the plan at any time and the employee will receive all of the monies which he has deposited in the fund through withholdings from his earnings. Even if every employee does not join the plan, it may be set up for any community and those that desire to join may do so.

There are certain limitations on how long a man may work if he is in the Pension Fund. These limitations depend on how old a man is, and how long he has served in the position. The amount of pension received depends on the total length of time worked, the amount of his salary, and his age at retirement. In any case there is a minimum annuity. The maximum at the present time is $1099.67.

From the questions asked of the speaker, it appeared that there is a great deal of interest in this plan not only on the part of the water works operator but also by municipal officials.

Sage Comment

Under the intriguing title "Random Lines," **Dr. A. A. Potter,** Dean of Engineering of Purdue University, made some very sage observations on the present conditions of this country. Dean Potter took as his thesis three themes: (1) Too few engineers take an interest in government affairs, (2) too many persons place security above opportunity, and (3) too many persons think that the federal government is Santa Claus.



Officers
(Left to right) Wm. Firth, Hammond, Asst. Secy.; J. L. Quinn, Terre Haute, Past Chair.; C. H. Bechert, Indianapolis, Secy.; B. A. Poole, Indianapolis, Director; T. J. Burrin, Lebanon, Chairman; R. B. Wiley, Purdue, Vice Chairman.

Free Residual Chlorination

C. D. Adams
Supt. of Water
New Albany, Ind.

N. S. Chamberlin
Tech. Serv. Div.
W. & T., Newark

Within these three themes, Dean Potter made a number of cryptic statements briefed here for the sake of space. "Industrial progress may be traced to our unusual government that has encouraged production . . . More than two-thirds of the great inventions in the world have been made by Americans . . . Water works men should take active part in government and not plead that they are too busy . . . Water works men should not avoid politics, but should aid in the election of better representatives . . . Getting into public life is an opportunity that should not be missed . . .

"Do not place security above opportunity . . . It is the risk takers who are the inventors . . . Social security carried to the extreme becomes insecurity . . .

"The government is not Santa Claus . . . We must resist expenditures not absolutely necessary, if not the government will become bankrupt . . . For our own protection we must resist inroads on the government treasury . . . We must demand and work for good government and keep this a land of opportunity and not one of insecurity . . . As citizens we must oppose legislation for unnecessary expenditures."

Dean Potter concluded with the hope that municipalities will not wait for handouts for construction of these post war plans that are ready now.

Obtaining Surplus War Material

Lt. Col. Lindon J. Murphy, USPHS, Specialist on Surplus War Materials, Chicago, Ill., gave the

assembled audience a complete story on Surplus Property and how to get it. Admitting that the condition of the material varied from bad

The Golden Mitten

Donor	Winner
John L. Ford	*Dr. Geo. E. Symons*
Ford Meter Box Co.	*Wtr. & Sew. Wks.*
Wabash, Ind.	*New York City*

to excellent, and that there is a lot of "red tape" involved, Col. Murphy said that there are hundreds of thousands of items available, many of which are of use to water works systems. These items run from bolts and nuts to complete water systems, and Col. Murphy suggested, "If at first you don't succeed, try, try again."

Municipalities should be well aware of the fact that they are entitled to 40 per cent discount from the list price of all articles, it being only necessary to make the statement on the order. One warning . . . "don't just ask for water works equipment when asking if it is available, ask for specific needs. Contact the nearest office to you. (These offices were listed in the March issue of *Water & Sewage Works.*)

Public Relations

Under the somewhat facetious title of "How Are Your Relations, Public, I Mean," **Dr. George E. Symons**, Assoc. Editor, *Water & Sewage Works*, presented several viewpoints on the matter of the application of public relations in water works management.

Briefly, public relations are the practical and continuous exemplification of cooperation between owner, management, and labor on the one hand and the consumer on the other. This cooperation must be to the end that the service rendered and product delivered is satisfactory to all concerned. One of the most vital factors in this cooperative approach is the truthful dissemination of information of interest to all parties.

Illustrating the approach to various groups interested, the customer, the worker, and the owner, with stories of actual incidents in water works management and operation, Dr. Symons said that a public relations program must have an objective. In the case of water utilities, the objective is to bring the knowledge and understanding of the utility policy to the workers, the customers, and the owners.

If water works management desires favorable public reaction one must be resourceful in telling a story, for that story must be told and retold to obtain acceptance and appreciation. To carry out any public relations program there is no substitute for truth, research, imagination, resourcefulness, cooperation, and work.

PUBLIC HEALTH

With **B. A. Poole**, Director, Indiana Bureau of Sanitation, presiding over the public health session, **L. E. Wickersham**, San. Engr., Amer. Water Works and Electric Co., spoke on the "Control of Cross Connections." Pointing out that between 1920 and 1936, 54 outbreaks of typhoid fever affecting 11,000 persons occurred, Mr. Wickersham said that 49, or 91 per cent of these outbreaks, were caused by cross connections with impure supplies.

Colored lines in manufacturing plants are recommended because in some cases, even where exposed pipes indicate no cross-connections, they have been found in tunnels or even underground.

To eliminate the threat of cross connections to health, Mr. Wickersham said that the American Water Works and Electric Co. has adopted a set of rules which object to all cross connections except interconnections approved by State health authorities. In some cases cross connections are tolerated, but the customer assumes all responsibility for those cross-connections classified as "tolerated."

Branch Offices of Indiana Dept. of Health

The Indiana Dept. of Health has been reorganized and its services expanded. As soon as staffs are available, there will be five branch offices, each covering 18 counties of the state. Each of the five districts will have a sanitary engineer and assistant, a doctor, and a nurse. More efficient service may be expected when these offices begin operation. The functions of these branch offices may be listed in nine categories:

1. Routine visits to water supplies and sewage plants.
2. Review routine operating reports.
3. Promote the installation of new supplies and extensions of old ones.
4. Assist in the sterilization of main extensions.
5. Control cross connections. A 15-year-old law prevents cross connections except where protective devices are used and examinations are regular.

Programmers

D. H. Harker	*C. H. Bechert*
Chief Engr.	*Div. Wtr. Resources*
Flood Control Com.	*Conservation Dept.*
Indianapolis	*Indianapolis*

6. Greater attention to semi-public water supplies.
7. Follow up on plans and specifications approved by central office.
8. Install signs labeling communities having approved water supplies.
9. Conduct one-day operators' meetings.

The functions retained by the central office are as follows:

1. Review and approve plans, engineering reports, and specifications.
2. Provide laboratory services.
3. Assist in the development and presentation of district meeting programs.
4. Consultation and assistance on special problems.
5. Certification of Qualifications of Operators, Conduction of Short Schools.

An advisory committee to the Dept. of Health includes two water works superintendents, two sewage works superintendents, one representative from Purdue, one representative from Univ. of Indiana, and one from the Board of Health.

It is of particular interest to note that the State of Indiana has adopted as its official Drinking Water Standards, the Drinking Water Standards of the U. S. Pub. Health Service.

FLOOD CONTROL AND WATER RESOURCES

Presiding at the session on Flood Control and Water Resources, was **Anton Hulman, Jr.**, of Terre Haute, Chairman of the Indiana Flood Control Commission.

Topographic Maps

T. P. Pendleton, Chief Topographic Engineer, Geol. Survey, U. S. Dept. of Interior, Washington, D. C., spoke on the "Need for Topographic Maps of Indiana" and said that lack of such maps had handicapped the work of agencies on flood control and water resources. While ten states are mapped completely, many of the maps are outmoded. Most mapping today is by a combination of aerial and ground mapping. Areas of surrounding states are mapped from 100 to 29 per cent,

but Indiana has had only 23 per cent of the state mapped and half of this is old and on a scale of 1 mile to the inch.

At the present rate of mapping it would take thirty years to complete the job. **Chas. H. Bechert,** Director of Water Resources Division of the Dept. of Conservation, wants the job completed in not more than ten years. The state is willing to expend $150,000 per year to cover half of the cost with the other half being borne by the federal government.

Flood Control Program

Col. D. B. Talley, Dist. Engr., Louisville District, Corps of Engineers, U. S. Army, presented "The Army Engineers' Flood Control Program for Indiana." These plans being essentially of local interest, the details of the program will not be delineated here, but Col. Talley did say that before the Army Engineers will start to work on any flood program three things are necessary: (1) The state must provide all rights of way; (2) the federal government must be held free from any damage resulting from the construction of the flood control project, and (3) the state must maintain all projects after their construction.

"The Program of the Indiana Flood Control and Water Resources Commission" was presented by **Clyde R. Black,** Secy., and **David H. Harker**, Chief Engineer, both of the Commission.

Mr. Black commented on the relocation of highway bridges and said that water works men should ask for the aid of the federal government to pay for the cost of water mains requiring relocation because of flood control projects.

In considering any flood control project, Mr. Black said that the overall conservation picture should be viewed with flood control and water supply both considered. Often times, it is impossible to justify the economics of a project solely on its flood control value, but when also considered for its effect on water supply in the area as well, the whole project may be well worth while.

Mr. Harker commented on the immediate objectives of the commission as the carrying out of the Army Engineers' Program, and the long range objectives as a thorough study of hydrologic conditions and the general flood control picture and the development of remedial measures therefor.

DISTRIBUTION

Thomas J. Burrin, Supt. of Utilities, Lebanon, presided over the session on Distribution. In the absence of Dewey Johnson, Asst. Engr. of the Cast Iron Pipe Research Assn., **Thomas F. Wolfe,** Engineer of the Association, presented a motion picture titled, "Installing Cast Iron Pipe." This film features the journey of a carload of pipe from foundry stock pile to backfilling of an underground installation. Not only are the accepted methods of handling and installing cast iron pipe shown, but the film also points out the difficulties resulting from careless and unsound practice.

Presiders

C. K. Calvert
Supt. of Purif.
Indianapolis
Water Co.

Anton J. Hulman
Chair., Flood
Control Com'n
Terre Haute

Following the motion picture, Mr. Wolfe presented a paper on "Cement Lined Cast Iron Pipe." Beginning with the introduction of tar-dipping in 1854, Mr. Wolfe traced the history of pipe lining for protection, ending with the modern development of cement coated cast iron pipe. Whereas pinhole tuberculation was the worst difficulty in tar dipped pipe, the joints were the bothersome problem in the first attempts at cement lining. Now, however, it is possible to obtain bell and spigot pipe coated with cement.

First attempts to line pipe with cement used a mandrel to squeeze the cement against the pipe surface. Next came centrifugal casting and lastly the extrusion method which gives greater production. Cement lined pipe may be easily tapped; it prevents turbidity in the water; it will mitigate taste and odor troubles, red water, and will not be injured by cutting. Its greatest value, however, lies in the maintenance of high "C" values. Whereas in tar dipped pipe, the "C" value may drop from 100 to 70 to 52 to 40 in 10, 20, and 30 years respectively, cement lined pipe which had a "C" value of 130 at installation had a value of 121 at the end of ten years.

After 23 years, it has been found that a 30-in. cement lined pipe was delivering more water for less cost than a 36-in. cast iron pipe.

The W.P.A. From Chicago

(Left to right) J. Leslie Hart, U. S. Pipe; Carl Brown, U. S. Pipe; Thos. F. Wolfe, C.I.P. Res. Assn.; L. H. Lingnor, "Water & Sewage Works"; Jas. R. Brown, Nat. Water Main Clean.

WATER QUALITY

The session on Water Quality was presided over by **Cecil K. Calvert,** Superintendent of Water Purification, Indianapolis Water Co., and the first speaker was **Clarence Adams,** Engineer, Indiana Gas and Water Co., New Albany, Ind.

Tastes and Odors

Mr. Adams read a paper on the "Control of Taste and Odor from Industrial Wastes" citing the problems brought to New Albany by the TNT, synthetic rubber and powder plant wastes discharged into the Ohio River during the war. Before the chlorination facilities were enlarged it was found that the water in the distribution system not only had vile tastes, but was colored as well. Experimental work indicated that free-residual chlorination would eliminate the difficulties and increased chlorinating capacity was provided.

Mr. Adams' work showed that simple excess chlorination was not necessarily the answer; effect of pH, and of time had to be considered, but the net result of the work was to produce a clear, colorless, tasteless water in the distribution system. By careful control of chlorine application to produce a free residual of approximately 1.3 ppm., the best results were obtained. Because of the type of wastes from powder plants it was necessary to use soda ash to maintain the proper pH and prevent red waters in the mains.

As a result of this free residual chlorination, Mr. Adams noted the following benefits: (1) Elimination of tastes and odors; (2) prevention of algae growths in the settling basins; (3) stabilization of sludge in settling basins and elimination of odors and tastes usually pro-

duced therefrom; (4) improved flocculation (but this was tricky as under some conditions the chlorine apparently peptized the floc and thereby increased the alum required); (5) practically complete elimination of lactose-fermenting organisms in the New Albany filtered water, and (6) a reduction in over-all chemical costs.

In the matter of algae control by free residual chlorination, Mr. Adams warned that it is necessary to bear in mind that during the daylight hours chlorine in settling basins is dissipated more rapidly under the effects of sunlight than it is at night.

In spite of the relatively high free residual carried into the distribution system, it was not possible to find a residual at the end of the system. Apparently tuberculation of long standing was consuming the chlorine. There were no complaints of chlorine tastes in the water when the free residual chlorine was maintained at 1.3 ppm.

In the discussion of this paper, **N. S. Chamberlin,** Sanitary Chemist, Technical Service Div., Wallace and Tiernan Co., Newark, said that it is significant that free residual chlorination has been effective in treating a variety of chemical wastes which produce tastes and odors. It appears that chlorine may act in three ways in removing these wastes. (1) Oxidation (or burning up) of more complex compounds to simpler compounds having no taste or odor. Removal of the essential oils of algae and the burning up of cyanides are examples of this class. (2) Production of insoluble compounds is exemplified by the chlorination of phenols, the TNT waste color about which Adams spoke, and the removal of some paper mill wastes. (3) Volatilization of taste and odor producing compounds by the production of a vehicle of volatilization such as nitrogen tri-chloride. When ammomia is present in water and is converted to nitrogen trichloride by free residual chlorination it will remove tastes and odors of butadiene and styrene, whereas these will not be removed by simple combined residual chlorination where the residual chlorine is in the form of chloramines.

Pollution Control

Prof. R. B. Wiley, Head of the School of Civil Engineering at Purdue and Chairman of the Indiana Stream Pollution Control Board, presented the "Standards and Accomplishments of the Pollution Control Board."

Admitting that the riparian owner has the right to the use of a stream in undiminished quantity and unchanged quality, Prof. Wiley said it was necessary to administer the anti-pollution regulations in light of the theory of reasonable use by each owner. With this in mind the board has adopted the policy that no person could maintain a nuisance. It is the purpose, therefore, of the board to see that pollution is abated.

After A Busy Day at Indianapolis
W. Wilbur Shaw (now Pres. and Gen. Mgr., Indianapolis Motor Speedway) after winning famous race in 1940. His story at banquet was outstanding entertainment.

If, as is contended, pollution is a matter of public health, why then is it necessary to drag in conservation as a reason for stream pollution abatement. If the nuisance is abated as far as public health is concerned, approximately 90 per cent of the problems of conservation will be solved.

Prof. Wiley reviewed the history of the formation of the Pollution Control Board up to its present organization consisting of one member from industry, one from agriculture, the Secy. of the Dept. of Health, the Lt. Governor, and two engineers.

To date 26 cities have employed engineers to develop plans in accordance with the orders from the Pollution Control Board, and seven industries have been ordered to install treatment plants. Working cooperatively with both municipalities and industry, it is expected that the abatement of pollution in Indiana will be an accomplished fact within a few years as the result of the policy of this Board.

"THE GOLDEN MITTENS TOURNAMENT"

For the first time in any section meeting a "Battle Royal" Quiz program was held between "Experts (Ordinary Folks away from home) and Local Talent (Indiana's Own Experts)" with the prize being a "Golden Mitten."

Refereed by M. H. Schwartz, Vincennes, with Prof. W. E. Howland, Purdue, as Scorekeeper, Jack Gordon, Rochester, as Time Keeper, and Hayes Kuhns, Phil Lessard, Lou Cantrell, and Fred Brune as Judges, the "tournament" was a so-called match of wits. The visiting experts were: "Len" Thompson, chairman, St. Paul; "Tom" Wolfe, Chicago; T. P. Pendleton, Washington; "Lou" Guepel, Washington; "Doc" Symons, New York; "Joe" Chamberlin, Newark; "Wick" Wickersham, New York; Col. Murphy, Chicago; and "Jim" Brown, Chicago. The Local Talent included: Paul Laux, Anderson, chairman; Ed Kinney, Indianapolis; Glen Garman, Lafayette; O. A. Newquist, Muncie; Leo Louis, Indianapolis; "Nemo" Niemeyer, Indianapolis, and H. J. Draves, Michigan City.

Each person on each side was assigned one question either serious or farcical by referee Schwartz, except that one "Doc" Symons of *Water & Sewage Works* was given five questions and by virtue of this finagleing was awarded the "Golden Mitten" presented by its designer, John L. Ford, of the Ford Meter Box Co., Wabash, Ind. (Note: A picture of "ye reporter" wearing the "crown" and the citation written by John Ford will be found in the May issue in "Here and There with Doc Symons.")

ENTERTAINMENT

In addition to the "Golden Mittens Tournament" held at the last session, the committee provided a very unusual, interesting, and entertaining feature at the annual banquet. Following the presentation of the awards and some harmonizing by an attractive trio of college girls as well as another songstress and a dancer, Chairman "Jo" Quinn introduced **W. Wilbur Shaw,** President and Gen. Mgr. of the Indianapolis Motor Speedway, who told the story of "A Busy Day At Indianapolis." After the talk was finished, Harry Jordan was heard to remark, "That should have been on a national network."

A CONDENSED OPERATING RECORD

"Well, how'd we do last month?"

That's the question we can hear Wendell R. La Due, Supt. and Chief Engr., of the Akron, Ohio, Bureau of Water and Sewerage, ask the staff member who is accustomed to bringing in to the boss Akron's single sheet "Operating and Cost Summary" for the month just closed.

By little more than a glance at this remarkably complete condensed operating summary, on an 8¼ x 11 inch sheet, Supt. La Due is able to get the answer to his question—"How'd we do last month?" Important, also, is the fact that the several key men of his staff can do likewise. This is so because the figures for the month are entered on a Monthly Summary Report form which is printed on tracing cloth, and as many prints are made from this master sheet as may be required for distribution.

Also, at a glance, the record can be compared with the record for the previous month, or the same month of the previous year, or with the treatment record for a month in which raw-water conditions were similar. "Did we have to use carbon last month—how many days—how much?" "What was the chlorine requirement for pre-treatment—how much was the cost up or down?" "How did we do on the all important ratio of wash-water used to water filtered last month—what cost?" "What per cent of water delivered to the Akron pumping station through the long transmission mains from the treatment plant was accounted for—any trend indicating growing main leakage?" "How did the power consumed and gallons pumped records for the electric stations compare—any indication of declining pumping efficiencies?" "What sort of coal were we burning last month—what boiler evaporation ratio?" These and many other questions can be answered at a glance when comparing these month to month Operating Summary Records.

One of these record sheets, which Mr. La Due refers to as "The Month at a Glance," is here reproduced. We fear that the reduction in size to 4⅝ x 6½ inches may make reading of the details tedious. If so, we suggest that rather than strain one's eyes or look up a magnifying glass to more readily see the vast amount of condensed data on these forms, any reader finding this form of interest should write to Mr. La Due requesting a print made from one of the original summary sheets.

CITY OF AKRON, OHIO — BUREAU OF WATER AND SEWERAGE

CUYAHOGA RIVER SUPPLY
SUMMARY FOR MONTH OF JULY, 1945

ELEV.-EAST BRANCH RES. 1ST. 1132.70 LAST 1132.01 MAX 1132.70 MIN. 1132.00
FLOW FROM EAST BRANCH RES.-M.G.D AVG. 14 MAX 61 MIN. 0
ELEV LAKE ROCKWELL 1ST. 271.40 LAST 271.04 MAX 271.65 MIN. 271.04
SUPPLY-RAINFALL 2.80 IN. RUNOFF 0.45 IN. 16 % OF RAINFALL. 52 m.g.d.

WATER DEMAND				
DRAWN	1,189.56 mil gal	38.37 m.g.d	100.0 %
LOST IN PROCESSING	3.00 mil gal	.10 m.g.d	0.3 %
WASH WATER	27.80 mil gal.	.89 m.g.d	2.3 %
DELIVERED TO H.L. PUMPS	1,158.66 mil gal	37.06 m.g.d	96.6 %
USED AT PLANT	9.33 mil gal	30 m.g.d	0.9 %
PUMPED TO AKRON	1,149.43 mil gal	37.08 m.g.d	96.5 %

ANALYSIS OF WATER	COLOR	TURBIDITY	BACTERIA AT 37.5°C	GAS FORMERS	B. COLI	pH	TOTAL HARDNESS	ALKALINITY	INCRUSTANTS	CALCIUM	MAGNESIUM	SULPHATES	CHLORIDES	IRON	FREE CO_2	TOTAL SOLIDS
	p.p.m.	p.p.m.	1 c.c.	100 c.c.	100 c.c.		p.p.m.	p.p.m.	p.p.m.	p.p.m.	p.p.m.	p.p.m.	p.p.m.	p.p.m.	p.p.m.	p.p.m.
RAW	39	7	70	24.0	15.2	8.0	103	84	19	32	5.0	27	5	0.55	0	124
FILTERED	13	0.8	1	0	0	7.5	117	76	41	38	5.0	45	9	0.05	4	132

FILTERED RUN 26.5 HRS. FILTERED WATER TEMP. 76 °F RESIDUAL CHLORINE 0.32 p.p.m.

CHEMICALS	Δ DAYS	DOSAGE UNIT	DOSAGE MAX	DOSAGE MIN	DOSAGE AVG.	POUNDS USED	PRODUCTION COST TOTAL	PRODUCTION COST PER M.G.*
SULPHATE OF ALUMINA		g.p.g	2.5	1.8	2.1	351,400	$4,480.35	$ 3.86
LIME	30	g.p.g.	0.8	0.3	0.6	100,850	635.96	0.55
FERROUS SULPHATE + Copper Sul	26	g.p.g	0.7	0	0.5	96,800	573.17	0.50
CHLORINE - PRE TREATMENT		p.p.m.	5.42	3.60	4.72	46,880	1,026.67	0.89
" - STERILIZATION		p.p.m.	1.20	0.42	0.67	6,655	145.74	0.13
ACTIVATED CARBON	30	p.p.m	4.03	0	270	26,847	1,127.22	0.96

H.L. PUMPAGE	HOURS	M.G.
PUMP No. 1	736.50	374.37
PUMP No. 2	735.25	454.56
PUMP No. 4	186.25	76.10
PUMP No. 5	551.25	253.63
STEAM TOTAL		1,158.66
PUMP No. 3	0	0
GRAND TOTAL		1,158.66
AVG.-HEAD 291.5 FT.		37.38 M.G.D.

L.L. PUMPAGE	HOURS	M.G.
PUMP No 1 - STEAM	71.00	122.90
" " 2 - "		
" " 3 - GAS	0	

ELECTRIC POWER	HOURS	K.W.H.
300 HP WHEEL	248.00	11,080
100 HP "	0	
No 1 TURBINE	0	0
No 2 "	0	
PURCHASED		28,230
TOTAL		39,310

TOTAL CHEMICALS	$7,388.51	$ 6.89
PAYROLL	2,258.62	1.95
MISCELLANEOUS	150.00	0.13
TOTAL-TREATMENT	$10,397.13	$ 8.97
COAL 1125.55 TONS	5,290.09	4.57
PAYROLL	5,165.32	4.46
PURCHASED POWER ø	359.01	0.31
MISCELLANEOUS	350.00	0.30
TOTAL-PUMPING	$11,164.42	$ 9.64
EAST BRANCH RESERVOIR	155.00	0.13
LAKE ROCKWELL	720.72	0.62
TOTAL RESERVOIRS	875.72	0.75
TOTAL SUPPLY	$12,437.27	$ 19.36
COAL DUTY - STEAM PUMPS		111.5
STATION DUTY - STEAM PUMPS		99.3
STATION DUTY - ALL PUMPS		99.3

BOILER No 1	16 DAYS	EVAP - LBS./LB. COAL	8.8
" " 2	17 DAYS	BOILER HP DEVELOPED	700
" " 3	31 DAYS	COAL - B.T.U	13,300
" " 4	24 DAYS	COAL - % ASH	7.96

REMARKS: * Delivered to H.L. Pumps
Δ Full month use unless noted
ø For both Treatment and Pumping (O E Co monthly bill ending 25th of month)
17.1 p.p.m. = 1 g.p.g 1 g.p.g. = 143 lbs./mil gal

Kreinheder Succeeds Alan Drake at Buffalo

Jerome C. Kreinheder has succeeded Alan B. Drake as Director of Water at Buffalo, N. Y. Mr. Kreinheder has lived his whole life as a resident of the city, has been connected with the automobile and airplane industries, and for the past eight years has been a member of the Assembly of the State of New York from Buffalo.

San Diego to Soften Colorado River Water

When the San Diego aqueduct became a certainty last year, it became evident that the water from the Colorado River would have to be softened. Accordingly a plant to treat 66 mgd. has been designed. It will include preliminary settling tanks, softening — coagulating tanks, settling tanks and filter units. The $2,000,000 water plant will be designed in Spanish style of architecture.

SURVEY OF ELEMENTARY MATHEMATICS

For Water and Sewage Works Operators

Part II

By WARREN K. EGLOF, Ph.D.
Prof. Chemical Engineering
NIAGARA UNIVERSITY, N. Y.

PHYSICAL UNITS

A *unit* is a single thing isolated by the mind and called one. A *number* is a unit or a collection of units secured by the processes of addition, subtraction, multiplication, and division. An *abstract* or *pure* number is used without reference to any particular thing. A *concrete number applies to a particular thing and is the product of an abstract number and a physical unit.*

Examples of physical units are—1 foot; 1 acre; 1 gallon; etc.

Rule: Concrete numbers can be added or subtracted only when they possess the same physical unit.

Rule: Concrete numbers having the same or different physical units can be multiplied, and, when this multiplication takes place the physical unit must also be multiplied, thereby creating a new physical unit.

$$\begin{aligned} 6 \text{ ft.} \times 7 \text{ ft.} &= 6 \text{ (1 ft.)} \times 7 \text{ (1 ft.)} \\ &= 6 \times 7 \times \text{(1 ft.)} \times \text{(1 ft.)} \\ &= 42 \times \text{ft.} \times \text{ft.} \\ &= 42 \text{ ft.}^2 \end{aligned}$$

1 ft.^{3} or 1 sq. ft. is a new physical unit

Similarly 4 (1 ton) x 3 (1 mile) = 12 (1 ton) (1 mile) = 12 ton-miles

A ton-mile is a definite physical unit and represents something done, associated with carrying a ton through a distance of 1 mile.

5 (1 man) x 4 (1 hour) = 20 (man-hours)

1000 (1 person) x 365 (1 day) = 365,000 capita-days

Rule: When concrete numbers are divided, the physical units are also divided. A physical unit in the numerator cancels a like physical unit in the denominator.

In general when the physical units are divided a new physical unit is created.

$$\frac{20 \text{ miles}}{2 \text{ hours}} = \frac{20}{2}\left(\frac{1 \text{ mile}}{1 \text{ hour}}\right) = 2\left(\frac{1 \text{ mile}}{1 \text{ hour}}\right)$$

or 2 *miles per hour*

Important Uses of Physical Units

The result of every calculation with concrete numbers will in general be associated with a physical unit that gives meaning to the numerical answer. The numerical answer should always be accompanied by its physical unit. Columns of data must always have the physical units expressed at the top. An important use for physical units is to determine how figures are to be combined to give the desired answer and to check the correctness of formulas for omitted quantities, and incorrect units.

Both sides of an equation must reduce to the same physical unit.

Problems: A flow is 40 ft.^{3}/sec. and the cross-sectional area is 20 ft.^{2}. What is the linear velocity of flow?

$$\frac{\text{ft.}^3/\text{sec.}}{\text{ft.}^2} = \frac{\text{ft.}^3}{\text{sec.} \times \text{ft.}^2} = \text{ft./sec.}$$

$$\frac{40 \text{ ft.}^3/\text{sec.}}{20 \text{ ft.}^2} = 2 \text{ ft./sec.}$$

Observe that physical units can be carried through a calculation without using the numerical values. This is done to determine the physical unit of the answer.

RATES

The concept of a rate is very important in all practical affairs. Rates consist of a number multiplied by a physical unit. This physical unit is formed by dividing one physical unit by another and is called the rate unit.

Example: A channel delivers in steady flow 5500 cubic feet (ft.^{3}) in 5 hours.

$$\frac{5500 \text{ ft.}^3}{5 \text{ hours}} = \frac{5500}{5}\left(\frac{\text{ft.}^3}{\text{hr.}}\right) = 1100 \text{ ft.}^3/\text{hr.}$$

Here we have a rate formed by dividing two concrete numbers. The rate should be visualized as the product of 1100 by the rate unit, which is 1 ft.^{3}/hr. This latter is read one cubic foot per hour, in which the "per" is equivalent to "each."

To develop facility in setting up and using rates, some thought must be given to the physical meaning of division. Division means distribution. The totality of things represented by the numerator are equally distributed among the units of the denominator. The result of the division is the parts of the numerator per, or to each part of the denominator.

$$\frac{50 \text{ ft.}}{2 \text{ sec.}} = 25\left(\frac{\text{ft.}}{\text{sec.}}\right) = 25 \text{ ft. per sec.}$$

$$\frac{500 \text{ gals.}}{2 \text{ persons}} = 250\left(\frac{\text{gal.}}{\text{person}}\right) = 250 \text{ gals. per person}$$

$$\frac{50 \text{ mgms.}}{25 \text{ liters}} = 2\left(\frac{\text{mg.}}{\text{liter}}\right) = 2 \text{ mgms. per liter}$$

$$\frac{75 \text{ cents}}{5 \text{ oranges}} = 15\left(\frac{\text{cents}}{\text{orange}}\right) = 15\text{c per orange}$$

$$\frac{100 \text{ cu. ft.}}{5 \text{ men} \times 4 \text{ hrs.}} = 5\left(\frac{\text{ft.}^3}{\text{men} \times \text{hr.}}\right) = 5 \text{ cu. ft. per man per hr.}$$

EQUIVALENTS AND CONVERSIONS

The following list of equivalents cover all ordinary needs in sewage and water problems:

1 meter	=	100 centimeters
1 centimeter	=	10 millimeters
1 inch	=	2.54 centimeters
1 pound	=	453.6 grams
1 gram	=	15.43 grains
1 ounce (av.)	=	28.3 grams
1 cubic foot	=	7.48 gallons
1 gallon of water	=	8.34 pounds
1 cu. ft. of water	=	62.4 pounds
1 cubic foot	=	28.3 liters
1 gram per liter	=	1 ounce per cu. ft.
1 gram per milliliter	=	62.4 pounds per cu. ft.
1 milligram per liter	=	1 part per million
1 grain per gallon	=	17.1 parts per million
1 part per million	=	8.34 pounds per million gallons
1 acre	=	43,560 square feet
1 gallon	=	3.785 liters
1 liter	=	1000 milliliters

The above list of equivalents can be extended indefinitely.

A much more comprehensive table of equivalents is to be found in the 1944 Reference and Data Number of *Water Works & Sewerage.*

Calculating Units

Sometimes a desired unit is not in the given list. If the desired unit is not present, it usually may be calculated with little difficulty.

The calculation involves two principles as follows: (a) physical units may be cancelled; (b) any quantity divided by its equivalent equals unity.

For example, to obtain the number of centimeters in one foot, this calculation resolves itself simply into multiplying the number of centimeters in one inch by the number of inches in one foot.

$$12 \times 2.54 = 30.48 \text{ cm.}$$

Problem: What quantity of water weighs one pound. If proportion, explained earlier, is used to convert the value of 8.34 lbs. per gallon shown in the table to gallons per pound we have

$$\begin{aligned} 8.34 \text{ lbs.} : 1 \text{ gal.} &= 1 \text{ lb.} : x \text{ gals.} \\ 8.34\,x &= 1 \times 1 \\ x &= 0.12 \text{ gals.} \end{aligned}$$

(Not quite a pint)

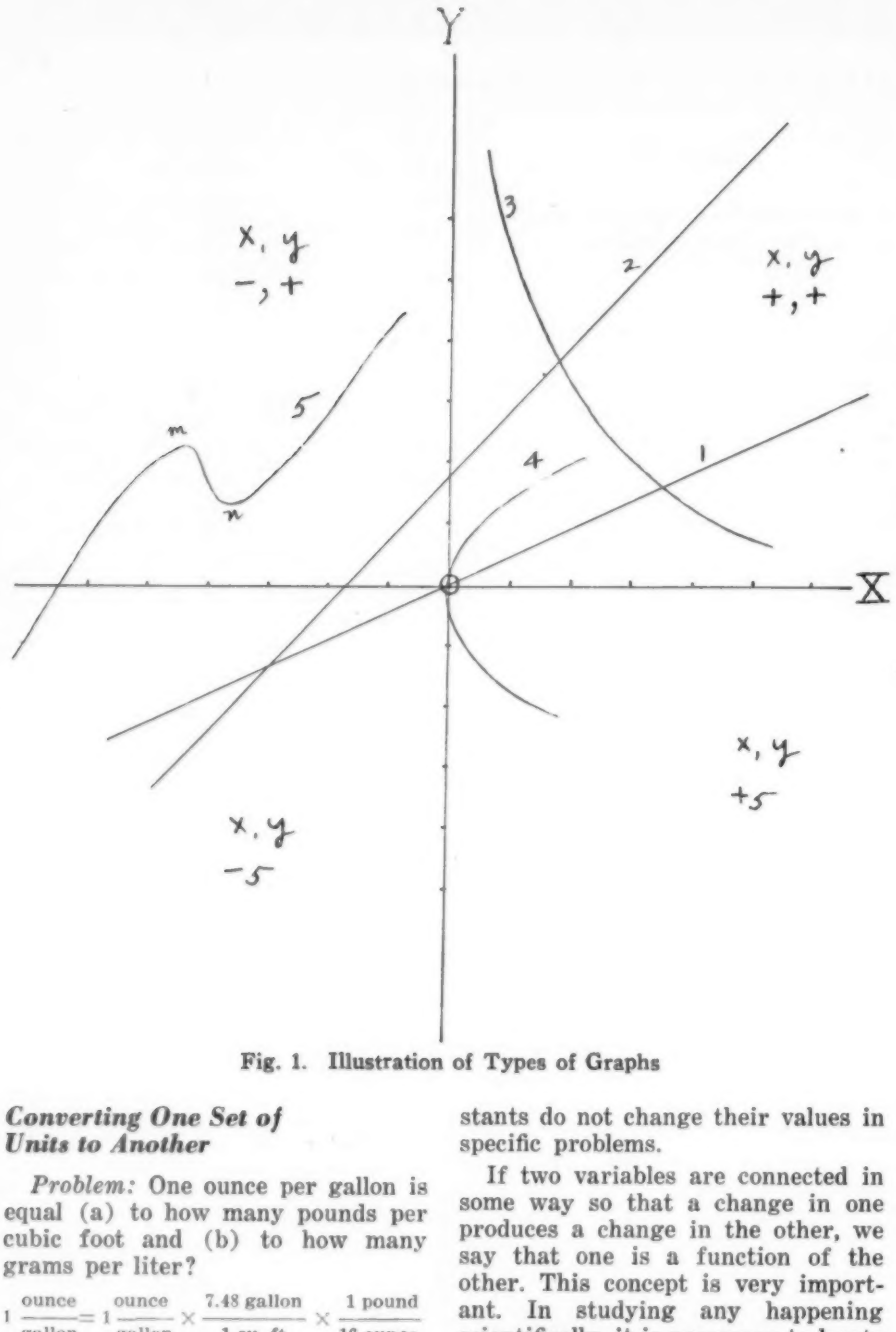


Fig. 1. Illustration of Types of Graphs

Converting One Set of Units to Another

Problem: One ounce per gallon is equal (a) to how many pounds per cubic foot and (b) to how many grams per liter?

$$1\ \frac{\text{ounce}}{\text{gallon}} = 1\ \frac{\text{ounce}}{\text{gallon}} \times \frac{7.48\ \text{gallon}}{1\ \text{cu. ft.}} \times \frac{1\ \text{pound}}{16\ \text{ounce}}$$

$$= \frac{7.48}{16}\ \frac{\text{pound}}{\text{cu. ft.}}$$

$$1\ \frac{\text{ounce}}{\text{gallon}} = 1\ \frac{\text{ounce}}{\text{gallon}} \times \frac{1\ \text{gallon}}{3.785\ \text{liter}} \times \frac{28.3\ \text{grams}}{1\ \text{ounce}}$$

$$= \frac{28.3}{3.785}\ \frac{\text{grams}}{\text{liter}}$$

Numerical values for equivalents or conversion factors in one set of units may be converted to another set of units in the above very simple manner.

VARIATION, GRAPHS, EQUATIONS

The various meters in a water or sewage treatment plant change their readings with changing conditions. Those quantities whose values may change are called variables. Constants do not change their values in specific problems.

If two variables are connected in some way so that a change in one produces a change in the other, we say that one is a function of the other. This concept is very important. In studying any happening scientifically, it is necessary to locate all variables, changes in which affect the happening under study. If possible, two variables are selected for study and all others kept constant. One of the two selected variables is arbitrarily changed and the effect upon the other is measured. The one changed arbitrarily is called the independent variable and the other the dependent variable.

The note-book now contains a table of data in two columns. For each "setting" of the independent variable, there will be a value for the dependent variable, the two values constituting a corresponding pair.

Graphs

In order to facilitate the study of the data, a graph is plotted. Ordinary graph paper shows a grid or net formed by two sets of parallel lines at right angles to each other.

In plotting, the *origin* is selected first. If the data includes negative values, the origin must be moved toward the center of the sheet. If negative values are absent, the lower left corner is selected. Two accentuated lines in the net at right angles to each other and both passing through the origin are designated as the *axes*.

Scales are assigned to the axes such that the smallest square has its sides represent 1, 10, or 100 depending on the range of the data. Scales need not be the same for both axes but they should be selected such that the graph roughly extends diagonally across the entire sheet. The scales must be such that the data can be plotted easily and quickly. A point is plotted by locating the value of the independent variable on the horizontal scale and from this latter point measuring on a vertical line, a distance equal to the dependent variable on its own scale. Positive values are measured to the right and upward and negative values to the left and downward. Usually a smooth curve is drawn or "averaged" through the points. This curve is the graph. Each point on the graph represents a pair of corresponding values for the variables. Several types of graphs are illustrated in Fig. 1.

Graphs are important because (a) the mind can note by a glance the general nature of the relationship between two variables; (b) a graph facilitates interpolation which means reading from the graph pairs of corresponding values that were not measured; (c) a graph shows up peculiarities; (d) graphs are used very frequently for rapid calculation; (e) graphs are used for computation that could not be made in any other way.

Algebraic Equations

So far, we have represented our data in two ways: (a) a table of measured values; (b) a graph. There is another way to represent a function. This is by means of an algebraic equation.

Consider Curve 1 in Fig. 1. This graph shows a very common and important type of relationship between two variables. The graph is a straight line passing through the origin. Whenever this occurs, the two variables are *directly proportional*. If the dependent variable be called 'y' and the independent variable 'x,' we say in this case that 'y'

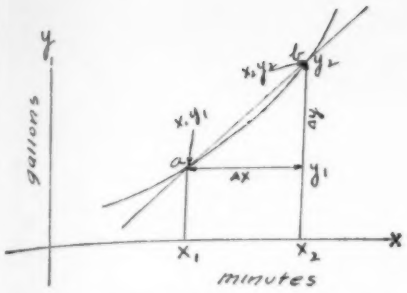


Fig. 2. Graph Showing Rate of Flow, Not Constant

varies directly with 'x' or that 'y' is proportional to 'x' or

$$\frac{x_1}{y_1} = \frac{x_2}{y_2}$$

where the subscripts denote corresponding pairs.

Since the ratio here of any 'x' to its corresponding 'y' is a constant we can write $\frac{x_1}{y_1} =$ some constant and also

$\frac{y_1}{x_1}$ = another constant that we can call k

therefore

$$y = kx$$

where K is the proportionality constant.

Note: If we know the value of k, we can dispense with the graph. $y = kx$ is a simple example of an algebraic equation that represents both a table of data and a graph. $y = kx$ is called the equation of the curve.

Consider Curve 2 in Fig. 1. Here the plotted measurements give a straight line but the two variables are not directly proportional. The equation for this graph is $y = ax + b$ where 'a' and 'b' are constants. 'a' is the slope of the graph and 'b' is the distance from the origin to the curve as measured along the 'y' axis.

Consider Curve 3. The product of 'x' and 'y' is constant, or $xy = k$. This is a common type of variation. We say that 'x' and 'y' are *inversely proportional*. This is so whenever the product of two variables is constant. An application of this is seen in the Venturi meter where the area times the velocity up-stream equals the area times the velocity in the throat.

SLOPES, RATES, AREAS UNDER CURVES

After data from a table have been plotted, some useful computations can be made from the graph. It is often necessary to know how rapidly a varying quantity is increasing or decreasing, i.e., its rate of change. This is the amount of change in the dependent variable per unit change in the independent variable.

Rates

On a graph, the rate of change is shown by the steepness of the curve and not by the height above the 'x' axis at any point. The steepness of any curve is expressed by giving its slope. Slope and rate of change are synonymous. Two kinds of rates must be considered: (a) average rate over an interval; (b) instantaneous rate at a point.

In Fig. 2 the curve represents total gallons that have flowed as a function of the time in minutes. The graph shows that the rate of flow is not constant because rates of change are constant only on a straight line graph. As a point travels from 'a' to 'b' along the curve, its coordinates change from x_1, y_1 to x_2, y_2. The increase in the gallons from 'a' to 'b' is y_2-y_1 and the increase in the minutes is x_2-x_1.

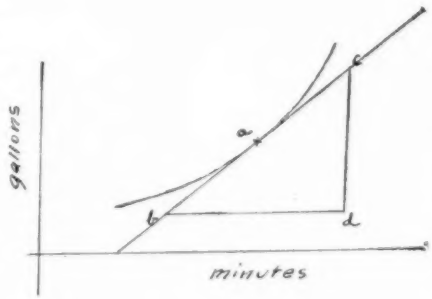


Fig. 3. Determining Slope or Instantaneous Rate at a Point

$$\frac{\text{increase in y}}{\text{increase in x}} = \text{average rate of change over the interval} = \text{change in 'y' per unit change in 'x'}$$

Note that the average rate of change over an interval tells nothing about how the graph changes throughout the interval. It is very important to distinguish between *average rate of change over an interval* and *the average value of the varying quantity* over the same interval.

In Fig. 3 an important idea is illustrated. If a point on the graph within an interval is kept fixed while the interval is steadily shortened, the average rate of change will approach and become equal to the instantaneous rate. The instantaneous rate or slope at a point is determined by drawing a tangent to the graph at the point in question and determining the average rate for the tangent. The average rate for the tangent is determined by drawing any right triangle **bdc** on the tangent and dividing **dc** by **bd** with the sides of the triangle expressed in the scale units.

Area Under a Curve

In Fig. 4 another important quantity for many graphs is illustrated. This is the area under the curve and bounded by the 'x' axis and the ordinates at the beginning and end of an interval. This area frequently has physical significance. It is approximated by splitting the interval into rectangles and drawing the top of each rectangle across the curve at a point that makes the area of triangle 1 equal to triangle 2. The height of each rectangle is measured in scale units and multiplied by the width in scale units. The area under the curve is the sum of the areas of these rectangles. The area may also be determined by a planimeter.

One very important use of this area is to obtain the average value of a varying quantity over an interval. This latter is obtained by dividing the total area by the base interval. This average value will be based on all the values of the varying quantity.

Average values for varying quantities determined in this way are usually more accurate than when based upon a limited number of readings. Whenever the product of two variables is sought, it can be obtained by plotting one variable as the function of the other and measuring the area under the curve between definite limits. If the velocity of flow is plotted as a function of time, the area under the curve represents total quantity. The volume of a reservoir or irregular object can be determined by plotting the cross-sectional area as a function of the height. If the concentration of suspended solids in a tank is non-uniform, the amount per cubic foot plotted as a function of the depth will give a curve, the area under which will be the amount of suspended solids in a vertical column 1 square foot in section. Accuracy increases with the number of levels sampled.

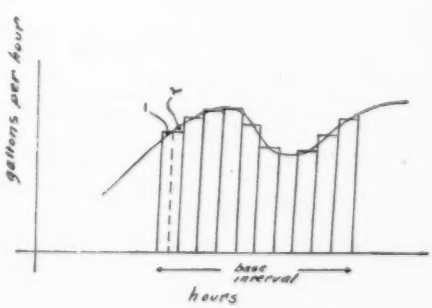


Fig. 4. Determining Area Under a Curve

A NEW METHOD OF HEATING SLUDGE DIGESTERS

Baltimore Adopts Direct Heating with Submerged Gas Burning for High Efficiency and Economy

By C. E. KEEFER
Principal Ass't Engineer
BUREAU OF SEWERS
BALTIMORE, MD.

DURING the past few years there has been a revival of interest in improved methods of heating sludge digestion tanks. In some instances new methods and equipment have been used, and in other cases a revival of old methods has resulted. For example, Rawn[1] injects steam in a digester at the Joint Disposal Plant of the Los Angeles Sanitation Districts, a method that is somewhat similar to that used over twenty years ago for heating sludge in Birmingham, England.[2] At the Back River Sewage Treatment Works, which serves the City of Baltimore, a new method of heating sludge tanks was experimented with during the summer of 1944 and has since been installed at the Reedbird Avenue Sewage Treatment Plant which is to serve the southern part of the city.

The Author

The heating equipment is quite simple, consisting of two parts—a carburetor and a gas burner, which

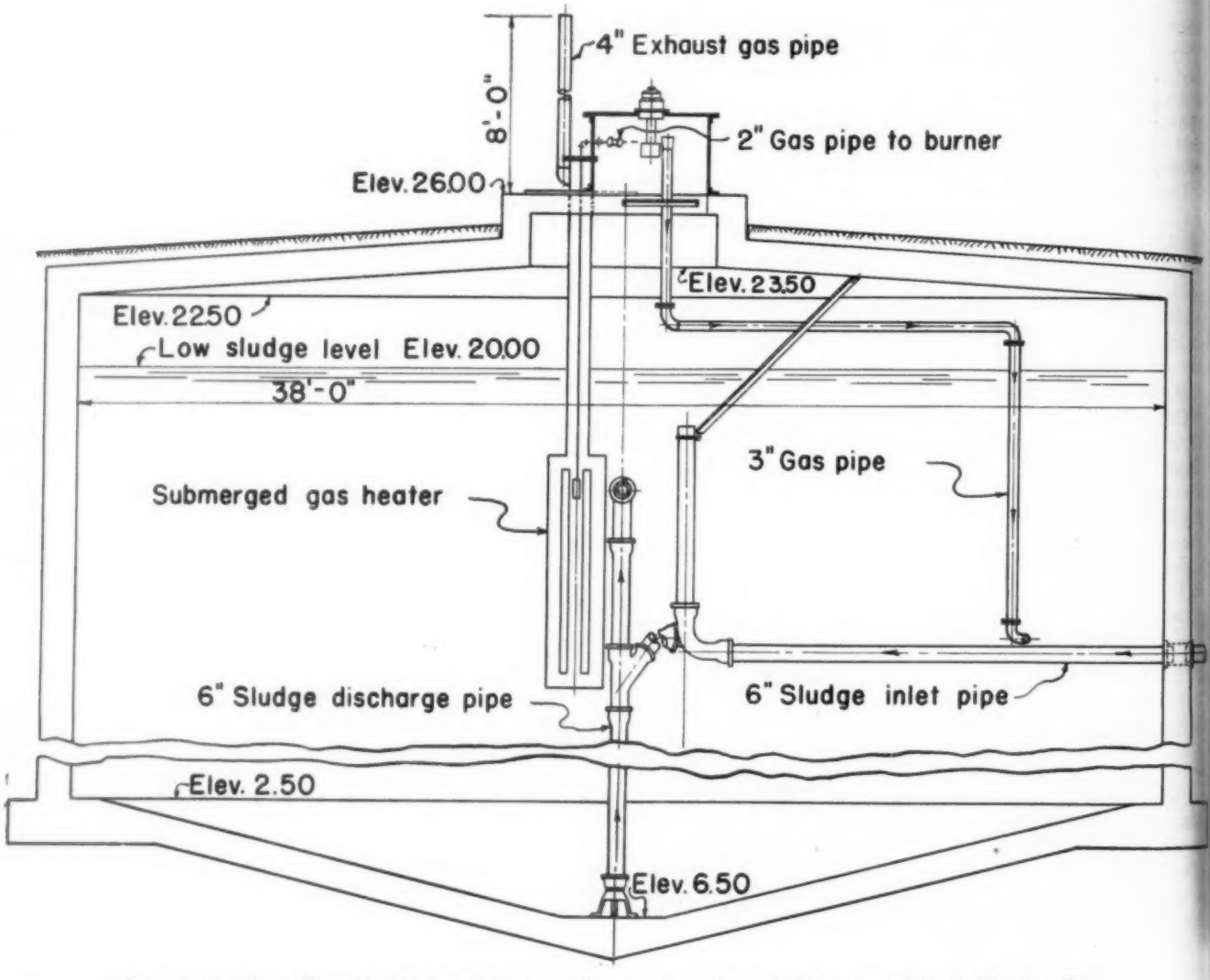


Fig. 1—Section Through Sludge Digester, Showing Location of Submerged Direct Heating Unit

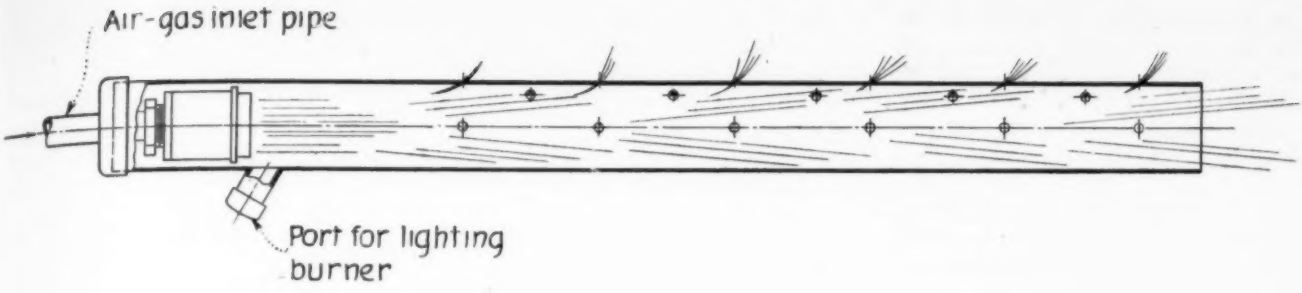


Fig. 2—Submerged Gas Burner of Open Flame Type

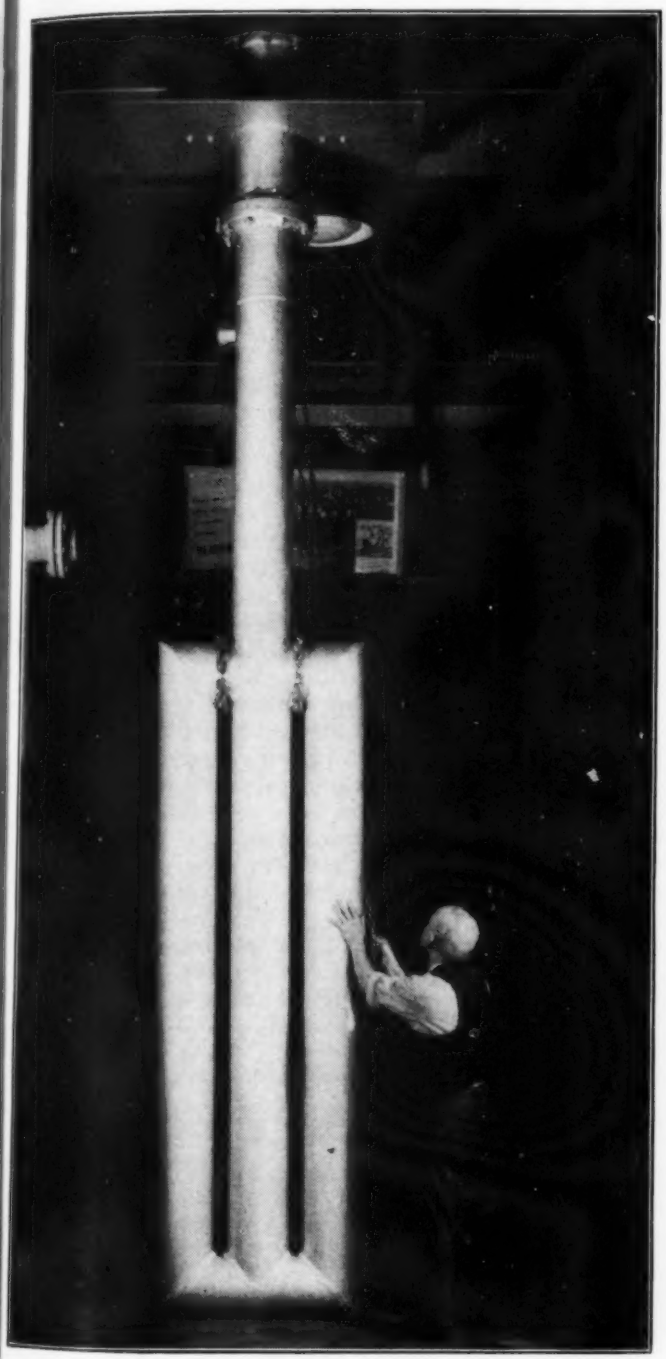


Fig. 3—Closed Type Submerged Gas Heating Unit Ready for Installing

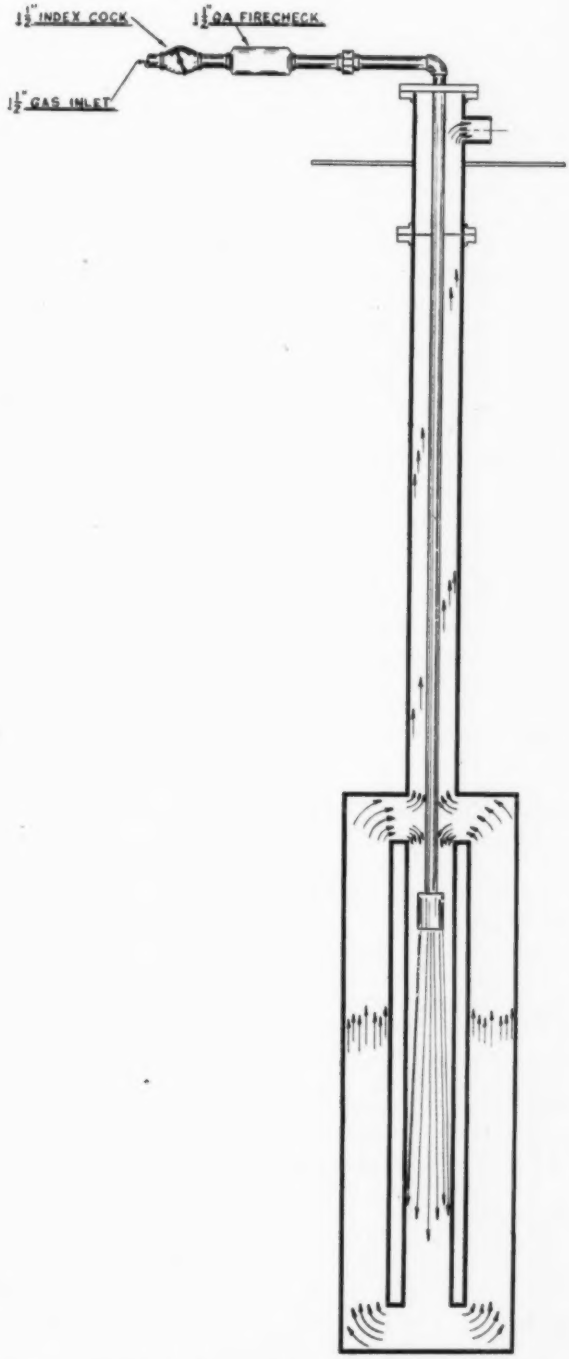


Fig. 4—Section Through Heating Unit, Showing Location of Gas Burner, Etc.

may be of the open or the closed type. The carburetor, which is usually motor driven, is designed to mix air and digester gas to be burned in any desired proportions, and pump it through a pipe line to one or more burners. The open type burner (Fig. 2) consists of a short length of pipe of any desired diameter, open at the discharge end. Near the open end is a perforated plate, through which the air-gas mixture flows. The burner can be ignited by an electric spark while it is submerged in the sludge. The pressure imparted to the gas by the carburetor must be slightly in excess of the hydrostatic pressure on the burner to permit the gas to flow. The advantage of this type of burner is that the flame and the burnt gases make direct contact with the sludge, the result being that there is practically no heat loss. The closed type burner (Figs. 2, 3 and 4) is designed so that the flame and the products of combustion are contained within a closed chamber constructed of pipe and immersed in the sludge. This equipment has been used for a number of years in the chemical industry and also for a wide variety of purposes such as the melting of type metal and the tin plating of sheet metal.

Experimental Trials

A 4-in. open type burner was tested for about two months at the Back River Sewage Works. It was submerged in one of the large open digestion tanks and operated continuously. From time to time it was examined to see if any insulating crust had formed on the outside of it; at no time had such a crust formed. An open burner has the advantage of not only heating the sludge but also of circulating the material by the ebullition of burned gases. The chief advantage of an enclosed burner is that it can be submerged to the desired depth in the sludge without requiring any added power to force the air-gas mixture through the burner. In the case of the open burner, the gas pressure needed will vary in direct proportion to its depth below the surface of the sludge.

Shortly after the above-mentioned tests were completed, it was decided to use an enclosed-type gas burner for heating the sludge digestion tank at the proposed Reedbird Ave. Treatment Plant. This plant, which has been designed to serve 10,000 persons for the present and 20,000 persons ultimately, consists of manually cleaned bar screens, a hopper-bottom sedimentation tank, 22 ft. by 44 ft. in plan with a working depth of 16½ ft., a covered sludge digestion tank, 10,000 sq. ft. of drying beds and provision for chlorinating the final effluent.

The digestion tank, which has a working capacity of 27,000 cu. ft., is 38 ft. in diameter and 26½ ft. from the surface of the sludge to the bottom of the tank. The sludge gases are collected under a gas dome in the roof of the tank and flow through a 3-in. pipe to a carburetor in an adjacent building. From the carburetor the air-gas mixture flows back through a 2-in. pipe to the burner, which is supported from the roof of the digester and immersed 11 ft. in the sludge (Fig. 1).

Heat Requirements

It is estimated that the heat required per hour to maintain a temperature 85° Fahr. in the digester under winter conditions will be as follows:

Heating Requirements	B.t.u.
Heating sludge	27,200
Heat loss from tank:	
Roof	23,800
Walls	32,700
Floor	17,800
Total	101,500

The gas burner is designed to produce 140,000 B.t.u. per hr. when burning sludge gas having a net heat value of 600 B.t.u. per cu. ft. During the early months of operation before an appreciable quantity of sludge gas is produced, bottled propane will be used as fuel.

Alternate Arrangement

In the Baltimore installation the gas burner is submerged in the digestion tank. An alternate design would be to put the burner either of the open or the closed type in a chamber through which the sludge to be heated would pass before entering the digester. Designs have also been prepared, which would provide for an open type burner in a covered digester and which would eliminate the possibility of the burned gases mixing with the unburned gases.

Selected Design and Arrangement

The closed heater at the Reedbird Ave. Plant consists of a grid of three 8-in. vertical tubular sections joined together at the top and bottom to form a continuous passage. The burner is in the middle leg and directs its flame downward. This flame is produced by burning a mixture of sludge gas and air supplied at a pressure of twelve ounces or more. The diameter of the burner is half that of the middle leg of the heater. The flame does not strike the walls of the heater but drives the combustion gases downward. The hot gases rise through the two outer legs and return to the middle leg at the top of the heater where they are, in major part, drawn down by the suction of the flame and mix with the gases produced by the flame. The burned gases discharge through the portion of the middle leg of the heater, which extends through the top of the digestion tank and into the atmosphere. These exhaust gases have no odor. As the heating is accomplished by the rapid circulation of the burned gas, there are no hot spots or high temperature zones. Since sludge gas, which consists principally of methane and carbon dioxide, is slow burning, it is difficult to hold a stiff blast flame to the surface of the burner.

The C. M. Kemp Manufacturing Co. of Baltimore, Md., which has developed this heating equipment has perfected a burner, to which the flame of this slow burning gas holds even when supplied at a pressure up to 48 ounces. A thermostat is employed to govern the gas input to the burner and prevent the sludge temperature from exceeding a predetermined amount.

The Reedbird Ave. plant is under the general supervision of Nathan L. Smith, chief engineer, Department of Public Works, and George E. Finck, sewerage engineer. The plant was designed by Whitman, Requardt and Associates of Baltimore.

References

1. Rawn, A. M.: "Water Works and Sewerage," **89**, 310 (1942).
2. A. E. Harris: "History of the Birmingham Tame and Rea District Drainage Board." p. 87 (1927).

WATER AND SEWAGE PATENTS

(OF RECENT ISSUE)

WATER PATENTS

Composition Containing Active Chlorine. Earl W. Smith (to Solvay Process Co., New York); U. S. 2,393,716; Jan. 29, 1946; (Appl. 5-19-42). A solid mixture containing Chloramine-B and an acidic salt of an alkali metal.

Centrifugal Pump. Alexander V. Mueller (to The Deming Co., Salem, O.); U. S. 2,394,931; Feb. 12, 1946; (Appl. 12-9-43).

Pump. Alexander V. Mueller (The Deming Co., Salem, O.); U. S. 2,394,932; Feb. 12, 1946; (Appl. 1-11-44).

Water Treatment and Composition. Charles S. King (to Brockson Chemical Co.); U. S. 2,395,126; Feb. 19, 1946; (Appl. 1-25-44). A water-treating composition in the form of a water soluble glass consisting analytically of Na_2O_3, Al_2O_3 and P_2O_5 in definite compositions.

Treatment of Boiler Water. Harold C. Farmer, Rosemont, Pa., and Sheppard T. Powell, Baltimore, Md.; U. S. 2,395,260; Feb. 19, 1946; (Appl. 8-5-43). Maintenance of a constant ratio of sodium chloride to total solids in water used for steam generation.

Treatment of Water for Boiler Feed. Chas. E. Kaufman (to Hall Laboratories, Pittsburgh, Pa.); U. S. 2,395,331; Feb. 19, 1946; (Appl. 6-21-43). Maintenance of potassium ion in boiler water by passing some of the water through a base exchange medium to remove calcium, magnesium, and sodium.

Liquid Treatment. Robert E. Seddig (to Graver Tank & Mfg. Co., E. Chicago, Ind.); U. S. 2,395,508; Feb. 26, 1946; (Appl. 10-6-41). A circular water treating tank, with treatment section in the center and filters disposed annularly with filter drains below.

Treatment of Water to Remove Silica. William S. Wilson and Howard Noyes Dole (to Monsanto Chemical Co., St. Louis, Mo.); U. S. 2,396,220; Mar. 5, 1946 (Appl. 4-2-43). Method of removing positive ion silica from water having a pH between 7.0 and 10.0, by subjecting water to treatment with a floc of a metal hydroxide consisting of ferric hydroxide, ferrous hydroxide, aluminum hydroxide or mixtures thereof. Treatment consists of counter current flow principle whereby water is brought into contact with floc containing successively smaller amounts of silica.

These patent abstracts being brief do not necessarily cover the entire scope of the invention described. If the reader becomes especially interested in any of these patents he should obtain printed copies of the complete patent, at 10 cents each, from the Commissioner of Patents, Washington 25, D. C.

Waterproofing Composition. Augustus B. Quick, East Norwich, N. Y.; U. S. 2,396,342; Mar. 12, 1946 (Appl. 2-11-44). A waterproofing composition comprising chlorinated rubber, a polyterpene, a water-insoluble and water-repellant metal soap, a fatty glyceride plasticising agent, and a volatile solvent.

Filter Bed Leveling or Scraping Means. Abraham B. Asch (to Charles E. Fraser, New York, N. Y.); U. S. 2,396,769; Mar. 19, 1946 (Appl. 2-14-42). A carriage adapted to travel back and forth over a filter bed, with a means to clean said filter bed by scraping and cleaning, and a means for raising and lowering the device to the surface of the filter bed.

Water-Treating Composition. Findley E. Hubbard and Campbell R. McCullough (to Monsanto Chem. Co., St. Louis, Mo.); U. S. 2,396,918; Mar. 19, 1946 (Appl. 5-2-41). Method of making a water treating chemical by humidifying powdered particles of a polyphosphate selected from the group consisting of alkali metal triphosphates, tetraphosphates, and decaphosphates, then screening and drying the agglomerates formed.

Valve. Philip K. Saunders (to Saunders Valve Co. of Amer., Inc.); U.S. 2,397,373; Mar. 26, 1946 (Appl. 7-8-43). A diaphragm valve.

Multiport Valve. Chester T. McGill, DeWayne Wessel, and Morris W. Smith (to Elgin Softener Corp., Elgin, Ill.); U.S. 2,398,437; April 16, 1946 (Appl. 8-24-42). A plate type valve with a plurality of ports.

Apparatus For Purifying Liquids. Frank Gaies Negus (to Aqua-Electric Corp., Halifax, Nova Scotia, Canada.); U.S. 2,399,289; April 30, 1946 (Appl. 10-26-43). A water purifying system utilizing the discharge of electric current through the water between two imperforate electrode plates, the upper of which is adjustable with respect to the lower. Water is discharged between the two plates from a conduit entering the center of the lower plate and is flowed radially outward between the plates.

SEWAGE PATENTS

Sludge Pump. Sigmund Schwartz, St. Albans, N. Y.; U.S. 2,396,290; Mar. 12, 1946 (Appl. 3-1-45). A jet pump.

Plug Valve Closure. Sven J. Nordstrom (to Merco Nordstrom Valve Co., Pittsburgh, Pa.); U. S. 2,398,444; April 16, 1946 (Appl. 12-23-43). A plug valve.

Filter. George E. Olson, Chicago, Ill.; U. S. 2,399,887; May 7, 1946 (Appl. 7-17-43). A rotary filter with necessary header connections for vacuum operation.

SLUDGE INDEX CONTROL BY CHLORINATION

Experiences at the Activated Sludge Plant of Tenafly, N. J.

By J. KENNETH ADAMS
Superintendent
DEPT. OF SEWERAGE AND SANITATION
TENAFLY, N. J.

THE growing interest in return sludge chlorination for density control leads me to offer this short account of its successful application at the Sewage Treatment Plant of Tenafly, N. J., which employs the activated sludge process.

First I would like to state my appreciation of two recent articles by Mr. John A. Tapleshay in the November 1945 *Sewage Works Journal* and in the March 1946 issue of *Water and Sewage Works*. His work gives concrete evidence of the value of chlorine in preventing sludge bulking and makes the first attempt to put the chlorine dosage on a rational basis that I have seen in print.

The Tenafly plant receives no industrial sewage of any importance. We have no primary settling tanks, the primary treatment comprising coarse and fine screening only.

There are no digesters. The waste activated sludge is dewatered on vacuum filters and dried in a Raymond Flash Dryer, and bagged for fertilizer, for which we have so far found a good market.

The plant is designed to handle 1.75 M.G.D. with a 5 hour detention period in the aeration tanks. Air is supplied through diffuser plates.

The clarifier effluent is further purified by its passage through sand filter beds and is also chlorinated before reaching a brook, which feeds an important public water supply reservoir.

Experiences With Chlorination

Our first attempt to improve the sludge index with chlorine was in December 1939. Our point of application was a reaeration tank used principally for sludge storage. We chlorinated only half the return sludge and got no results. The experiment was continued by applying the chlorine at the wet well, where it came in contact with *all* the sludge but only after the sludge was mixed with the screened sewage. About 6 ppm. was used, calculated on the volume of the returned sludge. A definite improvement in index was noted after a week. The sewage flow was very low and there was no urgent need of heavier sludge, so we learned no more about the effect of using chlorine for the next five months. This time we were in the midst of high flows during a wet spring and needed every aid we could find to make the sludge settle in the final tanks.

The Author

In the meantime we had enlarged the plant and acquired a more suitable place to apply the chlorine, that is, at the air lift box where the return sludge from both final tanks is mixed before it proceeds a few feet further to join the sewage. The contact period before it is mixed with the sewage is only about a half minute, with another equal period before the mixture reaches the aeration tanks.

For several years we have used the Donaldson Sludge Density Index, as it seems to us to be appropriate to have a rising index go with an increasing sludge density and an improving sludge quality. But it makes no difference at all which way the ratio of solids to settling is expressed. By many the Mohlman Index is used.

On the second try the chlorine machine was set at 18 lbs. per day. This rate of application gave 1 to 3 ppm., depending on the return sludge volume which is varied from time to time.

In eight days the index improved from 0.43-D (234 M) to 0.89-D (112 M), the letter "D" expressing the Donaldson Index and "M" the Mohlman Index. Chlorination was then stopped and the index improved in the next seven days to 0.94-D (107 M).

This test convinced us that there was something to the chlorination idea, but we had several disappointments during the next two years and found that we got better results by using more chlorine, usually 4 to 8 ppm.

Chlorination Effects Continue After Discontinuance

The chlorine treatment seems to develop a condition that carries over for several days to a week from the time chlorination is stopped. Our results confirm Mr. Tapleshay's experience that a smaller dosage may be used to hold a given level than is required to bring the sludge up to the desired point once it has gotten into poor condition.

High Solids Give Better Results Than Low Solids at Tenafly, But Require More Chlorine

At our plant we carry higher than average suspended solids in our aeration tanks. Our best operating range is 3500 to 4000 ppm. We are less likely to run into a sludge condition requiring chlorine when we carry high solids than if we get down to 2000 to 3000.

For example, from July 11 to Nov. 25, 1945, there was no need to use chlorine to hold a satisfactory index (0.95) while our aeration tanks suspended solids averaged 4420 ppm. During the first six months of the same year the index averaged about the same (0.91) with solids averaging 2890 ppm., but it is important to note that from January to June we had an almost continuous sequence of rising and falling indices, requiring frequent chlorine applications.

I wish we could say that high aeration tank solids are the infallible remedy against declining sludge density, but the fact is that even with solids averaging 4500-5000 ppm. we have resorted to chlorine to main-

tain the index. With the high solids we discovered that it took 10 days to two weeks of chlorination to secure satisfactory results, while with solids ranging from 2500 to 3000 ppm. it usually requires only five days to a week.

This would seem to indicate that there is a definite ratio between the total weight of organic content in the sludge returned and the amount of chlorine required to correct that condition of the sludge which causes it to become voluminous and bulky. This seems to be a logical explanation; the larger quantity of sludge in the tanks being less responsive to the fixed chlorine dosage that we have been in the habit of using.

When the sewage flow is high, thereby reducing available settling time in the final clarifiers, it is important to keep the index up so that the sludge will settle out and be compacted quicker. At such times we might start chlorination when the index drops to 0.85 while for lower and more normal flows we would wait until it reached 0.60. In very dry weather and low flows we have had very satisfactory operation even with the index below 0.50, but under average conditions this would be a bulking sludge with us.

We usually stop applying chlorine when the index goes up to 1.10 or 1.20. Of course, the main object is to reduce sludge volume and when the flow is higher than normal, this is of special importance. Cutting in additional settling tanks (for those fortunate enough to have them) can be avoided in spite of higher flow rates if the sludge index can be kept at its optimum. Almost any sludge will settle in a final tank if there is no limit on tank capacity, but a high sludge index will give better overall performance than several additional tanks. The phenomenon of "rising sludge" is not covered in this statement because this is a different condition.

Now Trying More Scientific Chlorine Control

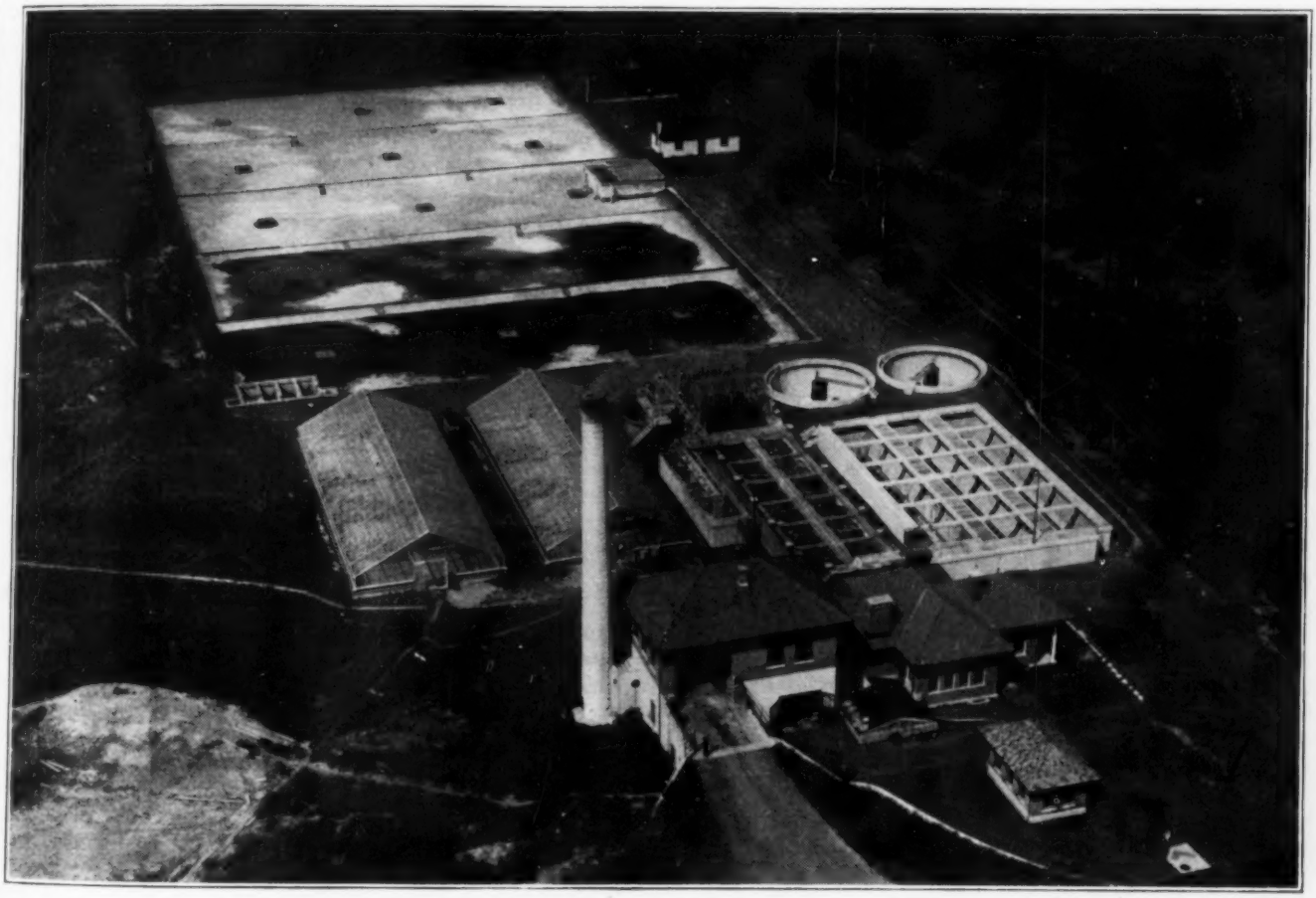
Until recently we applied chlorine at the same rate continuously from start to finish. The sludge return rate varied, making the dosage fluctuate between 3 and 8 ppm., averaging about 5 ppm.

Lately we have been following Tapleshay's suggestion (*W&SW*, March, 1946) of reducing the chlorine as the index improves, but have not yet decided to use a low dosage of chlorine continuously to maintain a good index. However, experience may prove this to be a very useful practice for us also.

We have tried much higher chlorination rates, up to 25 ppm., but the improvement does not seem to be accelerated by high dosages, and if prolonged for a couple of days, a noticeable turbidity in the clarifiers will result. It would appear that a moderate dosage and time for the cumulative but milder effect is a basic requirement for securing the optimum effect and economy. We do not know just where this limiting line is, because the results have been so good when averaging 5 or 6 ppm., calculated on return sludge volume, that we have not experimented any further.

Incidentally, we found a very noticeable decrease in spherotilis in the sludge during chlorination.

Of course, it is not always necessary to use chlorine to hold a good



The Activated Sludge Plant of Tenafly, N. J.

Plant contains no primary clarification units, but employs fine screening. Newer aeration units and final clarifiers on right. Note sand filters in background for further purification of activated effluent. These, with final chlorination, provide super protection of an important public water supply, and necessitate a high grade low solids activated effluent for successful operation.

index. The causes of bulking appear to be many and have been discussed frequently in the literature. The explanations are still rather obscure and it would seem that the phenomenon of why sludge settles or refuses to settle still offers a fertile field for exploration.

After our first couple of years of feeling our way along with this modern "elixir," chlorine, we have learned enough about its possibilities and limitations to enable us to use it confidently.

When used in quantities of 4 to 8 ppm. it has never failed us during the last four years if started within reasonable time after the sludge index begins to slide off. Improvement can be noticed in about two days, and the results desired are realized usually in less than a week. It will be noted also that we find chlorination is beneficial in cold weather, whereas others find it most helpful in warm, dry weather.

A typical example can be taken from our records starting Feb. 21, 1945, with a good index of 1.22, dropping in 11 days to 0.53. Chlorination at 4 ppm. (average) was started at 0.77, two days before the low point was reached. In eight days the index had recovered to 1.14 and continued to rise for two more days, reaching 1.23. Without the benefit of chlorine a decline then set in and a new cycle began.

Correcting a bulking sludge under our old operating technique was an expensive, heart-breaking, and long drawn out process, consisting of increasing the air as much as possible, and more important, of getting rid of almost everything in the system but the water. Almost any activated sludge plant operator will know what this means—lagooning, and what have you.

[Note—We have never enjoyed the ability to bypass the sewage because of the water supply situation.]

With high solids as our main standby for normal operation, we know we can depend on chlorine for an economical and rapid corrective for that very perplexing and disturbing phenomenon—sludge bulking.

It is as easy as going to the faucet for a drink of water. We just turn on the chlorine and watch the index improve, without having to resort to anything more drastic or expensive than this simple expedient.

Dappert, New NYSSWA Secretary

Succeeds the Late A. S. Bedell

Anselmo F. Dappert, Prin. Sanitary Engineer, Division of Sanitation, New York State Department of Health, Albany, was appointed Secretary of the New York State Sewage Works Association, to succeed the late Arthur S. Bedell, who died in April.

The appointment was made by the Executive Committee of the NYSSWA at its Spring meeting held at Utica, N. Y., May 23rd. Mr. Dappert is not only a charter member of the Association, but is a past-president of the organization, and has been a member of the staff of the State Health Department since 1921, when he transferred from the Illinois Department of Health. He served as a Captain in the Field Artillery in the 1st War and as a Lt. Col. in the Sanitary Corps in the 2nd World War. Mr. Dappert was assigned to the Military Government Section of the 10th Army, which occupied Okinawa. Mr. Dappert's terminal leave was completed in midwinter and since that time he has again been active in the work of the New York State Department of Health. In accepting the assignment Mr. Dappert becomes the second Secretary of the NYSSWA, Mr. Bedell having held that position from the organization of the Association until his death.

Alabama Water and Sewage Short Course

On May 22 to 25 inclusive, the Alabama State Dept. of Public Health, the University of Alabama, and the Alabama Polytechnic Institute sponsored the first short course and conference for Alabama water and sewage operators at Auburn, Ala. Lectures, demonstrations, papers, meetings, exhibitions, and discussions were held in the classrooms, laboratories, and auditorium of the college.

P.C.A. Appoints District Managers

Announcement has been made by the Portland Cement Association of the appointment of several district managers. Robert W. Winters has been appointed as manager of the West Central Offices, and Ed. J. Mueller is now district engineer in Kansas. Both men will make their headquarters at 1627 Dierks Bldg., Kansas City 6, Mo.

At the same time F. E. Votaw was appointed district engineer in charge of the Boston office, and a new office was opened in Denver, Colo. with E. W. Thorson as district engineer in charge.

R. B. Thomas City Manager of Corpus Christi

Roderic B. Thomas became City Manager of Corpus Christi, Texas on May 1st. Mr. Thomas, a graduate of Texas A. & M. in 1922, was employed by Myers and Noyes, Cons. Engrs. in Dallas, until 1928 when he was appointed City Manager of the Town of Highland Park in the Dallas area. Mr. Thomas is a member of the Am. Soc. of C. E.

Dual Disposal for Port Huron

Port Huron, Mich., has made plans to abandon hog feeding as a measure of garbage disposal and will construct a new sewage treatment plant which will treat both garbage and sewage. The garbage is to be ground for digestion with the sewage solids in the digestion tanks. Grinding is to take place at the treatment works.

According to the plan, the city is to furnish garbage cans for the home, leaving a clean can when the full ones are picked up to be carried to the sewage treatment plant. All cans will be cleaned and sterilized after dumping into the grinder.

THE MAGNETIC DRIVE

An Established Device Adapted to Variable Speed Centrifugal Pumping

By C. W. CAMP
Electrical Consultant
w ORTHINGTON PUMP AND MACHINERY CORP.
HARRISON, N. J.

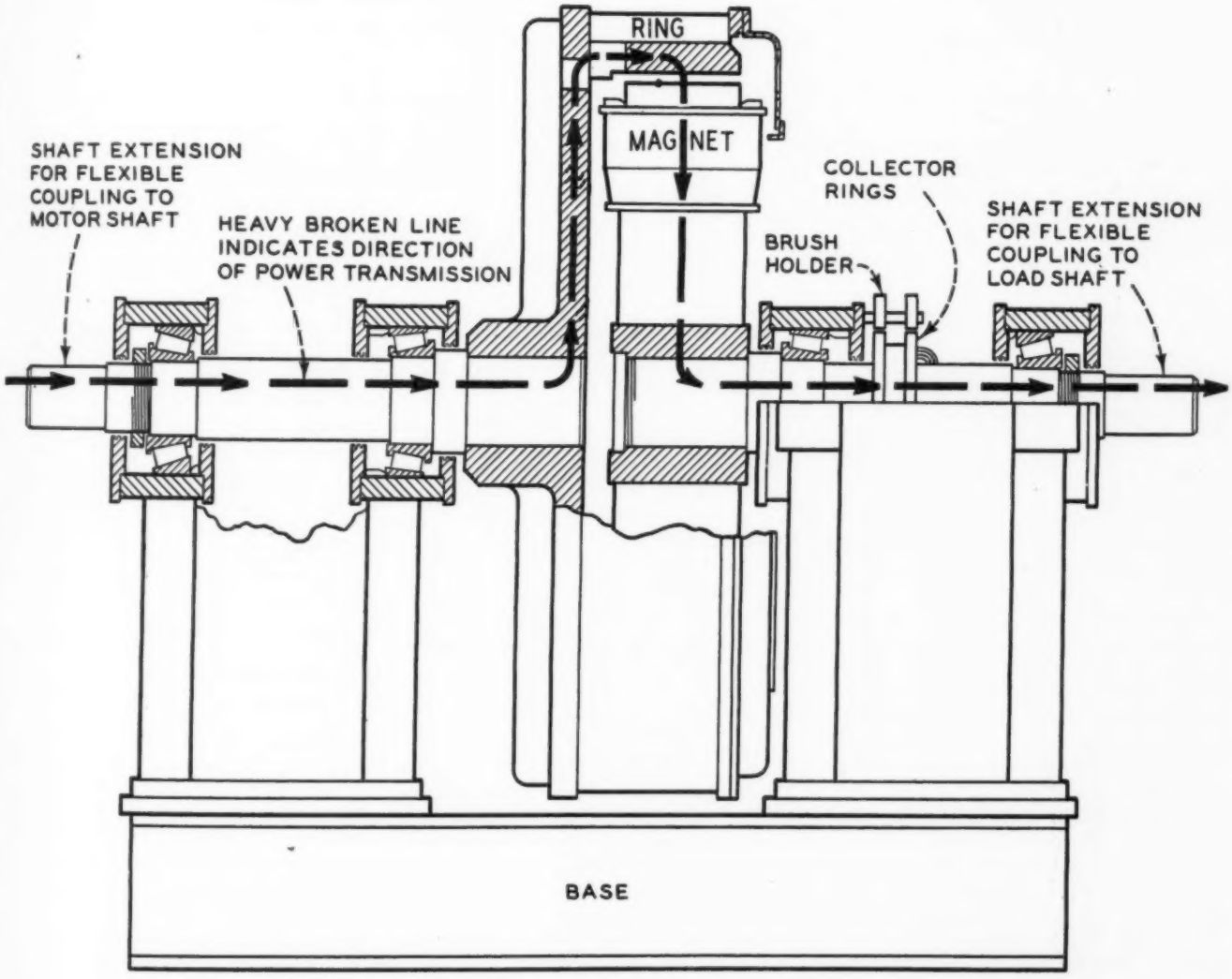
THE Magnetic Drive, originally furnished to automatically vary the speed of induced- and forced-draft blowers or fans, is now being offered as a unit providing variable speed drive for centrifugal pumps.

For automatic stepless speed control the Magnetic Drive is especially well adapted for use with sewage pumps, since with suitable master control the pump speed may be automatically adjusted to conform to changing sewage flows. The pump speed may thus be controlled to hold the liquid level in the pump-well within close limits. The high efficiencies and power factors, and the power factor correction obtainable with synchronous motors used in connection with the Magnetic Drive, represent advantages unobtainable with induction motors.

Past Practices

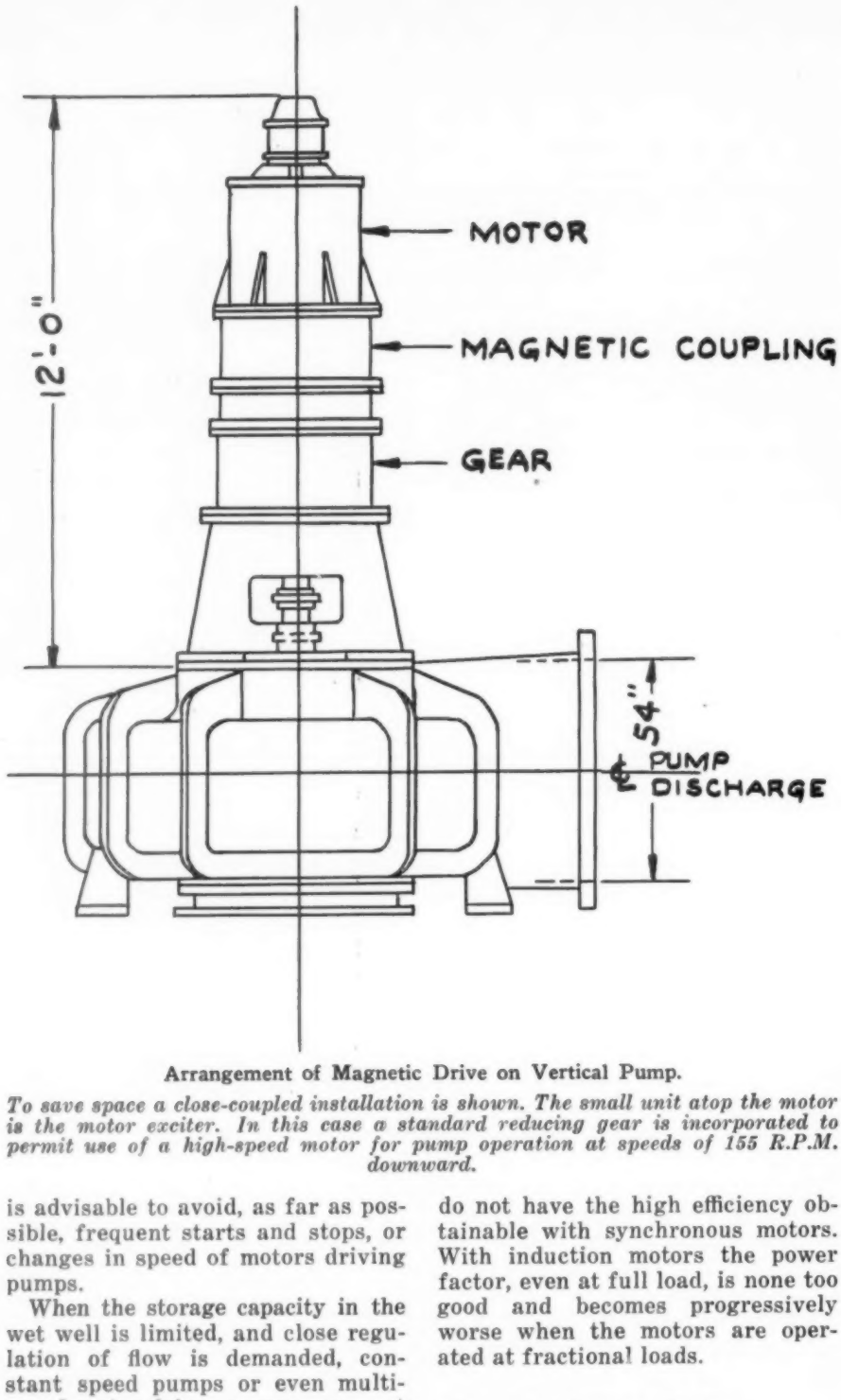
To contend with sewage flow variations over the average day, multiple pumping units are generally installed. These may all be driven at constant speed or some may be constant speed and some variable speed. Where storm water and sanitary sewage are handled by the same system, the maximum flows will be increased quite materially, necessitating more, or larger, pumping units than if the station handled sewage only.

Past practice, where the power source is alternating current and where a variable speed pump drive is required, called for the use of wound rotor motors, multi-speed squirrel cage motors, or two speed synchronous motors. In any plant, it



Diagrammatic Cross Section of E.M. Magnetic Drive for Horizontal Shaft Operation.

Note the air gap between the ring coupled to the motor shaft and the magnet, which is coupled to the pump drive shaft. No physical connection between motor and pump exists. The ratio between speed of magnet and pump shaft and the motor shaft and ring is determined by the controlled degree of excitation of the magnet. The result is an electronic fluid-drive effecting "micro-step" variations in pump speed and resultant delivery.



Arrangement of Magnetic Drive on Vertical Pump.

To save space a close-coupled installation is shown. The small unit atop the motor is the motor exciter. In this case a standard reducing gear is incorporated to permit use of a high-speed motor for pump operation at speeds of 155 R.P.M. downward.

is advisable to avoid, as far as possible, frequent starts and stops, or changes in speed of motors driving pumps.

When the storage capacity in the wet well is limited, and close regulation of flow is demanded, constant speed pumps or even multi-speed motor driven pumps, may not be the best selection. The wound rotor motor, with the conventional secondary resistance control, is used in some cases to meet this condition. With wound rotor motors, the speed is controlled by varying the resistance in series with the rotor. For automatic operation, the speed from minimum to full speed, must be varied in steps or "jumps," depending upon the number of points embodied in the control.

Induction motors, either the wound rotor or squirrel cage type, do not have the high efficiency obtainable with synchronous motors. With induction motors the power factor, even at full load, is none too good and becomes progressively worse when the motors are operated at fractional loads.

What the Magnetic Drive Consists Of

The corporation with which the author is connected has originated a new method of controlling pump speed in "Micro-Steps" where variable speed is required, utilizing a device produced by the Electric Machinery Mfg. Co. that has performed with the greatest satisfaction in connection with forced or induced draft fans. This device is called the Magnetic Drive. It has the advantage of being simpler and more dependable than an induction motor. It has an air-gap, comparable with those used on synchronous motors of equivalent torque rating.

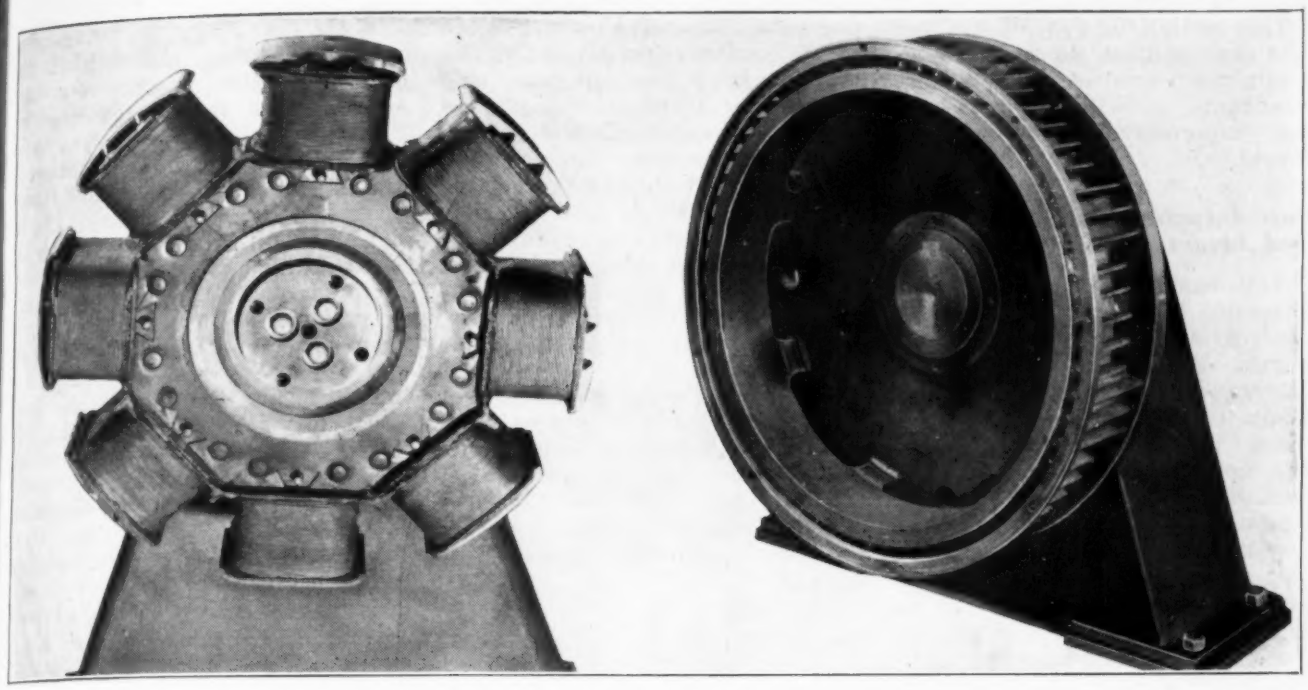
The Magnetic Drive consists of only two main elements, the magnet and the ring. The magnet consists of salient poles mounted on a spider and carrying field coils. The construction is practically the same as the rotor of a synchronous motor. The ring, in the smaller sizes, is of solid steel construction, the torque being produced by eddy currents in the ring. In the larger sizes, the ring carries a laminated core and a cage winding, the torque being produced by circulating currents in the cage winding. The prime mover recommended is usually a constant speed synchronous motor, which may either be unity or leading power factor to supply power factor correction throughout the load range. There is no reason why an induction motor can not be used if it is preferable, but synchronous motor efficiencies are notably higher for the reasons stated.

If the maximum pump speed is low, a high speed motor may be used by inserting a reduction gear between the motor and the pump. With higher speed pumps, the reduction gear is eliminated.

In either case, the Magnetic Drive outer element, called the ring, is mounted on or coupled to the motor shaft and runs at the motor speed. The inner element, termed the magnet, is mounted on or coupled to the pump shaft or to the high speed shaft of the reduction gear, as the case may be. Absolutely no mechanical connection exists between the motor and the gear or the pump. The torque is transmitted magnetically through the air gap between the magnet and the ring. In general, then, the principle is that of "fluid drive," except that an electrical field is employed instead of a fluid.

How Variable Speed Is Obtained

Variable speed is obtained by variation of the excitation to the magnet of the drive. The excitation is supplied from a three-phase rectifier incorporated in the magnetic drive control, and is varied by a small potentiometer rheostat which controls the electronic tube output. This potentiometer rheostat is positioned by some type of automatic control element such as a float mechanism, pressure cylinder, etc. With this method the control cabinet may be located where convenient, with the potentiometer



Magnet and Ring.

The magnet is of salient pole construction, both simple and durable. The winding has Class B insulation, providing high margin of protection.

Rings for the smaller Magnetic Drives are of the "eddy current" type—an annealed steel ring with integral radiating fins. For larger drives the rings are of the "cage current" type.

rheostat similarly located. The small wiring between the rheostat and the control cabinet will carry voltages on the order of twenty or less, and but a fraction of an ampere.

In pumping sewage (or storm water) the float is preferably located in the suction well, out of range of and shielded from disturbance and turbulence. In other installations the pumping rate (speed of pump) may similarly be controlled from the discharge side of the pump.

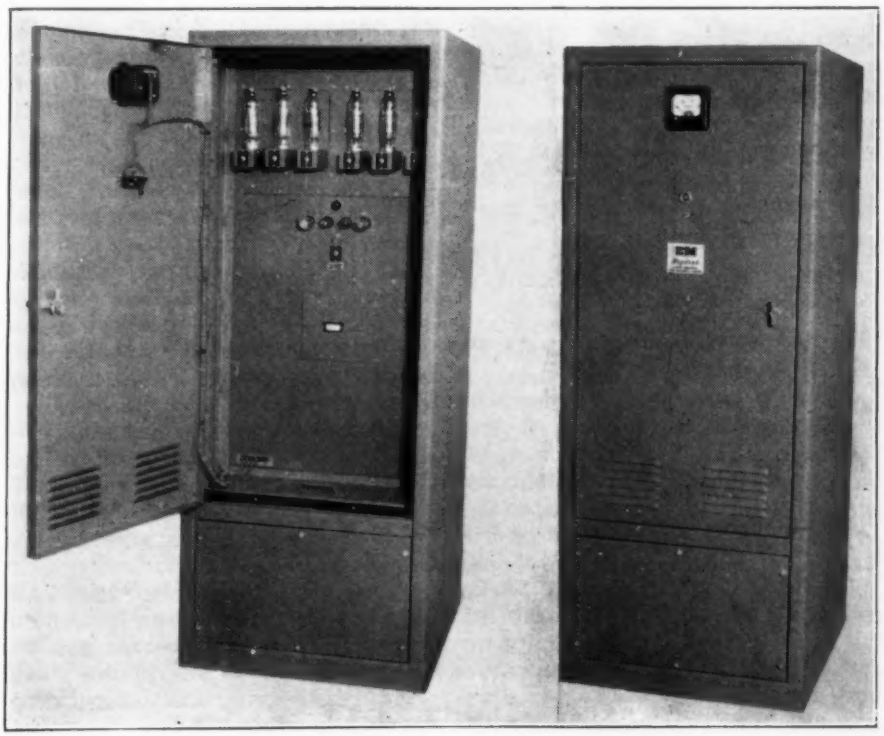
An individual float may be used to control each pumping unit or a single float may control all pumps. With this system all pumps that are operating will run at the same nominal speed (within plus or minus 1 per cent) thus giving the highest system efficiency. The pump speeds will increase or decrease simultaneously, being governed entirely by the liquid level through the float control.

Automatic programming may be arranged in the control so that with increasing flows succeeding pumps will be started; and, on decreasing flows, pumps will be stopped.

The control may be arranged with suitable selector switches for either automatic or manual speed control. It may also be arranged for the manual starting of the synchronous motors with automatic or manual speed control at will thereafter.

The float control operating the potentiometer rheostat is designed for speed control from the maximum to the minimum levels encountered in the operation of a particular station.

In starting a unit, the motor is started and synchronized with the Magnetic Drive "dead." Then the application of excitation to the drive starts the pump, which will come up to the same speed as the other running units. All running units will then automatically adjust their speeds to correspond with any fluid level changes in the suction well.



Electronic Controller for Magnetic Drive.

The E. M. "Regutron" Controller, open and closed. Note easy access to tubes, within, which may be replaced without taking the control unit out of service or otherwise interfering with operation

This method of control will enable sewage plants to operate with a minimum number of high class attendants, or will permit use of less experienced operating personnel.

Varied Applications And Advantages

This control method is equally adaptable to horizontal or vertical shaft pumps. For horizontal shaft pumps, the motor and drive may be mounted on the same base with the pump, to preserve accurate alignment. With vertical shaft pumps, the motor is supplied with a ring base which houses and protects the Magnetic Drive. The ring base is centered on and bolted to the reduction gear; and, in turn, the reduction gear is centered on and bolted to the pump casing. If the reduction gear is not used, the motor ring base is then centered on and bolted to the pump casing. This latter construction preserves the original alignment and eliminates the need of a separate motor floor. No long connecting shaft is required, so that this and the steadying bearings are eliminated. Slight changes due to foundation settlement will not affect the alignment of the pump and the drive.

The Magnetic Drive may be used for variable speed with any type of centrifugal pump, or with other loads where the horsepower varies as the cube of the speed. Consideration is also being given to its use in connection with boiler feed pumps.

With the Magnetic Drive, the speed change is accomplished in a smooth line pattern over the entire speed range, and not in "jumps." The speed is changed only with *sustained* fluid level changes, which precludes "hunting" and surges. Being an electric "fluid drive" coupling, shocks will not be communicated from the load to the motor, because effective cushioning is provided as the result of power transmission through the air gap of the Magnetic Drive. With changing liquid levels, the motors are not frequently started and stopped. Instead, they are always running at *constant speed*, and the speed changes, performed by the Magnetic Drive, reflect in more or less motor load as the speed of the pump is increased or decreased.

Ziegler Heads Erie Water Bureau

Theodore J. Ziegler has been appointed Office Manager of the Bureau of Water of Erie, Pa., to succeed the late B. J. Lechner. Mr. Ziegler has been with the Water Bureau of Erie since 1929, and has held the position of deputy city treasurer and accountant. There were a number of other changes and promotions in the water bureau at the same time. J. D. Johnson is Superintendent of the Water Bureau.

T. J. Ziegler

Correction Please!

Seeholzer is a Manufacturer's Agent on His Own

On page 178 of the May issue of *Water & Sewage Works*, in the report on the New York Section A. W. W. A. meeting in Elmira, there appears a picture of Bert Seeholzer and John D. Hall, Superintendent of Filtration at Batavia, N. Y. Bert Seeholzer is not associated with Northrop and Co. as he is there labeled. He has not been with that company for some time but is a manufacturers' agent on his own, as was announced in this magazine in November, 1945. Among the products for which Mr. Seeholzer is best known, through his long association with it, is the joint compound, "Hydro-Tite," manufactured by Hydraulic Development Corp.

We are very sorry that a lapse of memory occurred when it came to captioning this picture of Bert.

Fellowships for Sanitary Engineers

Surgeon General Thomas Parran of the U. S. Public Health Service has announced that a grant for the establishment of 125 Fellowships to train physicians and sanitary engineers in public health has just been approved by the National Foundation for Infantile Paralysis.

Each Fellowship provides a year's graduate training in a school of public health or a school of sanitary engineering.

The Fellowships are available either during the academic year beginning in the fall of 1946 or the fall of 1947, and are open to men and women, citizens of the United States under 45 years of age.

The purpose of the Fellowships is to aid in the recruitment of trained health officers and public health engineers to help fill some of the 900 vacancies in public health medical positions and 300 vacancies for public health engineers existing in State and local health departments over the country. The Fellowships are reserved for newcomers to the public health field and are not open to employees in State and local health departments.

Applicants for Fellowships may secure further details by writing to the Surgeon General, U. S. Public Health Service, Attention: Public Health Training, 19th and Constitution Avenue NW., Washington 25, D. C.

Clay Pipe Lasts A Long Time

Excavations in Babylonia have unearthed clay sewer pipe used in a house sewer in 3100 B. C., as shown in the accompanying photograph. Other excavations have revealed clay pipe drains with "T" fittings laid in an arched aqueduct of bricks at Nippur, one of Babylonia's ancient cities which flourished in 4500 B. C. Another instance of the use of clay pipe in ancient civilization was recorded by historians on the island of Crete. In the palace of a king at Brook Knossos there was uncovered an amazing system of clay pipe sanitary drains installed about 3500 years ago.

A House Sewer in 3100 B.C.

ODOR CONTROL AND CONTROL OF FILTER FLIES*

A Review of Current Practices

By A. A. HIRSCH
State Department of Education,
BATON ROUGE, LA.

THESE subjects, control of odors and filter flies, are associated because trickling filter units are usually involved, and because certain of the control measures are of value with both difficulties. Whereas odors may occur in any type of plant, filter flies are usually, but not necessarily, specific to trickling filters.

The Author

ODOR CONTROL

Causes of Odors

Not considered here are odors due to overloading of a receiving stream with raw or settled sewage, or introducing untreated sewage into an otherwise adequate body of water, but without proper provision for mixing and carry-off. For the latter case, an intercepting sewer, installed to move the outfall to a more remote or turbulent location, frequently solves the problem.

Broadly classified, odors may arise from either:

(a) Receipt of stale or septic sewage at the treatment plant;

(b) Failure of treatment units to perform properly; or

(c) A combination of both causes (a) and (b).

Septic sewage emanates odors of decomposition in which that of hydrogen sulfide predominates, mingled with ammonia, amines, mercaptans, and indol and skatol derived from decomposition of proteins. Tallowy odors form from changes in fats.[1] Hydrogen sulfide, detectable at 0.001 ppm. concentration in air, is produced by the bacterial splitting of complex sulfur-containing compounds, and by the anaerobic reduction of sulfates, attributed mainly to *Vibrio desulfuricans*.[2] Odors are more prevalent in hard water regions where sulfates are high, or when sulfur-containing wastes are disposed of through the sewers. Hydrogen sulfide is also the principal toxic component of "sewer gas," one part in 20,000 of air causing marked irritation to eye and respiratory membranes.[3] In the collection system, hydrogen sulfide also destroys mortar joints and concrete pipe, particularly above the flow line where oxidation and moisture form sulfuric acid in dilute solution. In addition, manhole steps and cast iron manhole covers are destroyed in the same manner. At the plant, the efficiency of primary sedimentation is reduced, the liquor is harder to treat and is liable to release odors on the filters. Production of hydrogen sulfide in septic sewage continues through the primary settling tank, especially so when this unit is excessively large for the sewage flow. A simple test for the presence of hydrogen sulfide in a sewer atmosphere consists in exposing a strip of filter or blotting paper moistened with a 5% lead acetate solution; darkening indicates a positive test. Lacking lead acetate, a silver coin rubbed bright will turn brown where hydrogen sulfide exists to a degree which will cause odor nuisance or create acid attack.

Operating troubles that are liable to develop odor conditions are generally those that interfere with primary sedimentation or with percolation through the filters. Since septic sewage settles poorly in the primary tank, suspended solids are carried over to the filter where they cover over the zoogleal film, or plug the stones to form pools of quiescent liquor that ferments on standing. Overloading of primary tanks or a low rate filter frequently leads to ponding of the filters. In the Imhoff tank, deposits allowed to remain on the sloping floor, or too high a sludge level, reaching into the slot, release bubbles in the settling compartment, thereby interfering with sedimentation. Sprinkling of septic liquor through the atmosphere releases odors, particularly on hot, humid, still nights when temperature promotes decomposition and motionless air conditions cause the odor to hug the ground. Occasionally, the filter bed itself is the source of ponding, when too fine a filter medium is provided, or when the fines are all dumped in a few areas, or when stones are broken by careless placement. Sand beds will hold ponds when overloaded, or when not raked over the surface frequently enough to break up the top deposits.

Other minor sources of odor in the plant are from accumulations of screenings or unwashed grit deposits, and from discharge and wetting by rain on beds of poorly digested sludge. Odors from waste digester gases are avoided by burning in a field torch, or discharging through a high-level stack. When high buildings are nearby, chlorination of the gases prevent complaint from odors.[4]

Physical Control of Odors in Sewers

More advantageously prevented than removed, the three C's of odor control have been stated as: care, cleanliness, and chlorination. Prevention is concerned with the early arrival of fresh sewage at the treatment plant through clean, well-sloped lines, and the orderly management of the primary tank to permit unhampered sedimentation, and of the filter unit to prevent ponding.

Flow of water at a manhole does not indicate a clean sewer; even a fire plug discharge soon levels out to merely a fast-moving stream in the sewer. This flow may flush along loose materials, but revolving jets or blades are needed to scour the walls clean. Roots are removed by means of a helical cutting auger.

*A paper presented at the Eighth Annual Short Course for Superintendents and Operators of Water and Sewerage Plants, held at Louisiana State University, Baton Rouge, La.

Physical Control of Odors at the Plant

Overcapacity of primary tanks may be reduced by cutting unnecessary units out of service, or by dilution, through recirculation of the filter effluent.

Pooling over the filter surface may be corrected mechanically by such methods as providing proper sedimentation, forking the stones to an 8- to 12-inch depth, poking through ponds with a slicing bar, hosing with a heavy stream from a fire hose, withdrawing the filter from service for one or two days, or by flooding for three to four days. Ponded areas of stone may be dried out for several days by closing off individual distribution laterals, or by plugging sections of the revolving arm. Distribution piping and underdrains should be flushed out when possible. Weeds and other vegetation should not be permitted to grow on the filter bed. Localized overdosing of certain areas on the bed, sometimes a cause of pooling, may be determined by means of a pan test in which a row of cans is lined radially outward from the center-post, and their catchment measured after several revolutions of the distributor. From the relative volumes of liquor, each square foot of surface should be dosed alike, the nozzles are adjusted to spread the flow evenly. Operating nozzles should be kept cleared.

Presence of filter flies below the density that causes nuisance has been noted to clear ponded areas[5, 6] by the voracious feeding habits of the larvae on the biological film. On the other hand, many filters are in operation without ponding and with flies practically absent.

Chemical Control of Odors in Sewers

Chlorination up-sewer, in sub-residual dosage, prevents growth of sulfate-splitting bacteria and postpones decomposition of organic material, thereby controlling formation of hydrogen sulfide in the sewers. A four-day retention test with raw sewage showed that at least 20 to 25% of the chlorine demand must be satisfied to suppress sulfides to below 1 ppm.[7] Due to poor mixing, sludge deposits, and side wall slimes, a notably higher dosage, generally around 10 ppm., but ranging from 3 to 30 ppm., to satisfy up to 50% of the chlorine demand, is required in the sewer lines.[8] If hydrogen sulfide has already been formed, much more chlorine is required to react in chemically equivalent quantity, namely, 2.1 ppm. of chlorine per one ppm. of hydrogen sulfide removed. A portable chlorinator is useful for this operation, and its programming should be based on a survey for both hydrogen sulfide and residual chlorine. Chlorination also reduces the 5-day B.O.D. about 2 ppm. for every part per million of chlorine absorbed.

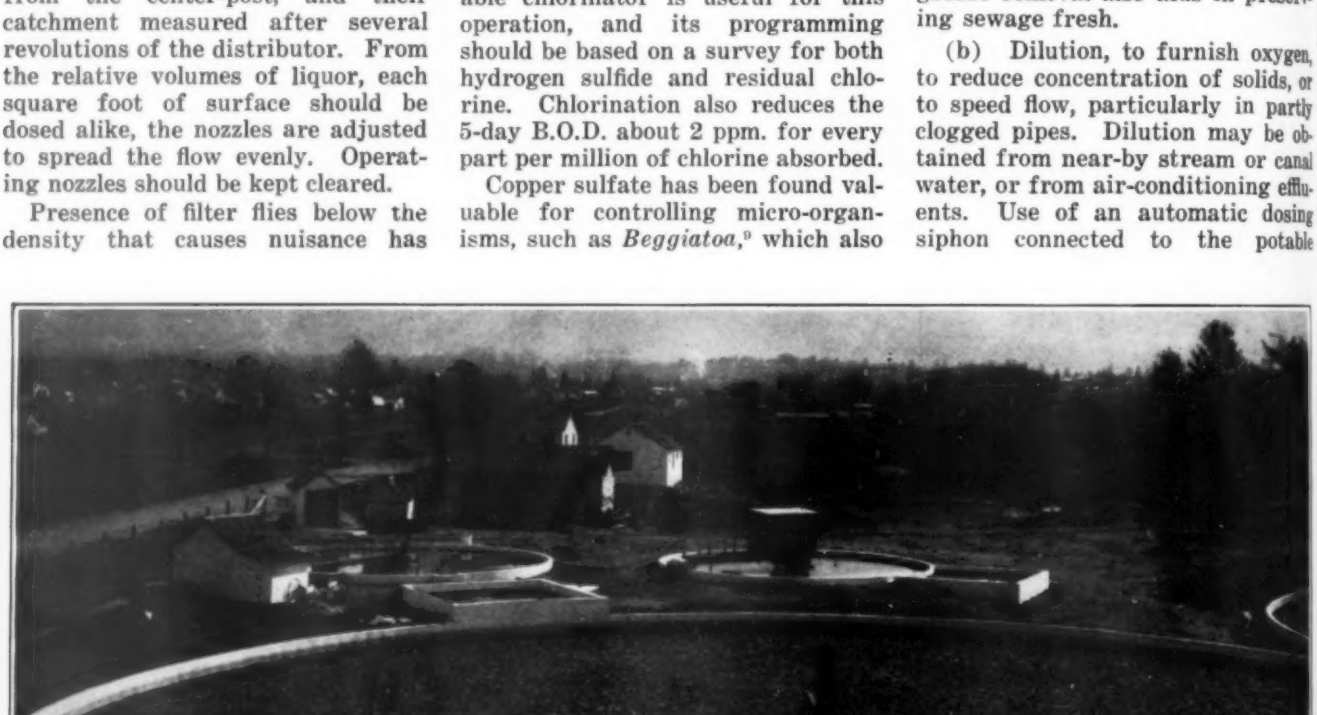
Copper sulfate has been found valuable for controlling micro-organisms, such as *Beggiatoa*,[9] which also is thought to produce hydrogen sulfide from sulfates, as sulfur granules are visible in the cell contents. Roots in the sewer are killed by flushing through 3 pounds of this chemical from a house toilet. A complete flush should be provided, as the concentrated solution is corrosive to iron pipe. For keeping sewage fairly fresh, 2 pounds is applied through a manhole, during low flows to conserve chemical. Sewage from lines so treated, is reported to reach the disposal plant without change in pH-alkalinity balance.

Ferrous chloride, produced by passing a chlorinator discharge upwards through a contact tower filled with scrap iron, removes hydrogen sulfide by direct combination chemically; it is especially useful when the hydrogen sulfide concentration is already high.

Other methods[10] for odor control include:

(a) Aeration, to furnish oxygen and to inhibit anaerobic decomposition, particularly that by the sulfate-reducing organisms. Pre-aeration, 0.05 cu. ft. per gal. of sewage, for grease removal also aids in preserving sewage fresh.

(b) Dilution, to furnish oxygen, to reduce concentration of solids, or to speed flow, particularly in partly clogged pipes. Dilution may be obtained from near-by stream or canal water, or from air-conditioning effluents. Use of an automatic dosing siphon connected to the potable



A Trickling Filter Which is Beginning to Show Signs of Ponding in Right Foreground

water supply is a dangerous practice, allowing possibility of back-siphonage.

(c) Temperatures below 70° F., to prevent growth of sulfate-reducing microorganisms.

(d) Chilean salt-petre, to furnish oxygen through chemical reaction and thereby prevent breakdown of sulfates.

Chemical Treatment for Odors at the Plant

Inasmuch as most trickling filter units are provided with chlorinators, 3 to 6 ppm. dosage in the wet well or the dosing tank is used to relieve septic action in the primary settling tank or to reduce release of odor at the filter nozzles. Application of dry hypochlorite, about 10 pounds per 1,000 sq. ft. filter area, directly on the bed is widely used to correct ponding by sloughing off some of the biological film. Caustic soda, sprinkled over the surface of a clogged filter, removes deposited grease, forming soluble soaps which are washed away. A 55-ft. filter was so-treated with 150 pounds of flake caustic.[11]

Chemical coagulation, as with ferrous chloride or ferric chloride, made locally by passing chlorine water over scrap iron and tin cans in a ceramic Scott-Darcy tower, removes odor by adsorption and by direct action with hydrogen sulfide.

Chlorinated hydrocarbons, such as Chloroben,[12] dripped into the trunk sewer in advance of the wet well, inhibits the organisms responsible for septic conditions in the Imhoff settling compartment, and so prevents formation of odors in these units. Activated carbon, 3 to 5 ppm. dosage, has corrected odors, during summer, in septic primary and secondary settling tanks.[13] At another plant, 17 to 25 ppm. of carbon, applied through a homemade feeder to the primary tank influent reduced the odor satisfactorily.[14] For trapping odors during transfers of sludge into tankers for dumping at sea, the Wards Island, N. Y., plant passes displaced air through a dust filter, and then through cannisters of activated carbon made from cocoanut shells.[15]

Lime treatment of sewage reduces odor due to hydrogen sulfide, but increases ammoniacal odors.[16] Ozone, introduced into the body of the sewage, and ozone-laden air, contacting the surface layer, have been proposed for sterilization and deodorization.[17] In two recent symposia[18, 19] are reported the odor experiences of nearly 30 contributors; a later article surveys odor-reduction practice at various plants in New York state.[20]

FILTER FLIES

Two species of moth-fly cause nuisance in percolating filter plants, *Psychoda alternata*, in hot and warm countries, and *Psychoda severeni*, in cooler climates. From egg to adult stage for development of the fly varies between 10 days to 3 weeks, according to season and temperature. Eggs are deposited in the moist film; pupae and larvae grow in the interstices between the stones. Larvae move about like worms in the slime, submerging their heads while searching for food and breathing through the tail; they can survive submergence for some time. The protected under-surface of the stones become covered with mature insects. The body of the adult fly is gray-brown, with long, transparent wings. Their dense hairs present resistance to flight, and restrict travel. Flies are found also around unprotected latrines and open gutters receiving sewage. Methods for their reduction or elimination may be by biological, mechanical or chemical means.

Biological Control

A mixed micro-fauna, containing forms more carnivorous than psychoda, has been recommended for biological control,[21] *Archorutus viaticus*, a small, blue-black, wingless, jumping insect, keeps filters relatively free of flies. Presence of frogs and snails is noted by several operators to be helpful.

Flooding

In filters having solid side-walls, flooding for 12 to 24 hour periods, at intervals for two weeks, wash out larvae and eggs, with slight temporary reduction in efficiency of the biological film. If flooded at night, some of the adult flies are entrapped in their hiding places, and are drowned. Where flooding is impossible, controlled drying, as for ponding, may be beneficial.

High-Rate Filtration

Flies are said generally not to breed on recirculating filters[22] over which the influent is continuously dosed. Unloading of the film is continuous, thereby denying a stable location for the deposition of eggs. This unloading feature also controls ponding. Nevertheless, installations of this type are known to become infested and one even to increase breeding.[23] High-rate filters allow a monopoly by only one or two species, in contrast with a more varied fauna in ordinary filters.[5]

Screening

Filters with open stone, piled along the angle of repose, or having open checker-work walls, by giving easier access to the adult fly, seem to favor breeding more than do those of solid brick or concrete wall construction. However, even completely enclosed filters have been noted not to prevent the spread of flies.[24] To screen effectively, the filter is best provided with artificial ventilation, the exhaust duct is screened, and such insects as are caught there sprayed with insecticide. High grass and weeds on the adjacent lawn should be mowed close to the ground to eliminate resting places.

Blow-Torch

Flames impinging over the tops of the filter stones destroy eggs and larvae near the surface of the bed, and kill adult flies that are hit.

Chlorination

A 3 to 5 ppm. dosage of chlorine in the applied settled sewage, every five to ten days, is effective, but better economy is obtained by spreading hypochlorite powder over the filter surface. Chlorination is best applied at night, during low flows, to conserve chemical. One method[23] consists in stopping the flow, spreading 100 pounds of hypochlorite per 500 sq. yd. of filter surface, dosing two minutes, then draining for 15 minutes. This procedure repeated three times abates flies for a week, without appreciable detriment to biological activity of the filter.

Insecticides

Contact of various pyrethrum, rotenone, creosote, nicotine, and many other insecticidal solutions with larvae and adult flies is effective. A kerosene solution containing ½ pound of pyrethrum flowers per gallon, occasionally stirred for 24 hours, makes a satisfactory spray.[25] Chloroben,[12] applied for odor control, also exhibits incidental larvaecidal action. Housefly pupae and larvae, frequently found in sludge drying on sand beds, have been killed by a spray of No. 2 Diesel oil.[26]

Especially conspicuous and promising is "DDT" (p,p'—dichlorodiphenyltrichloroethane), a contact insecticide, generally stable to light and oxidation, and compatible with most of the other insecticidal ingredients. On account of its war-restricted distribution the possibilities of this

chemical around the sewage plant are only beginning to be realized, and may provide for complete elimination of undesirable insects. At a Louisiana army camp, several pounds of "DDT," dissolved in kerosene and applied experimentally at the dosing tank to a large recirculating filter, killed all flies almost instantaneously, but caused a visibly increased unloading from the stone for several days. For best results, the rotary filter arms and all other structures offering a resting place for adult flies were also sprayed. This chemical can be applied within plant buildings as a spray or as a brushed coating. Plywood panels, coated with an oil-bound paint containing 5% DDT, kills domestic flies.

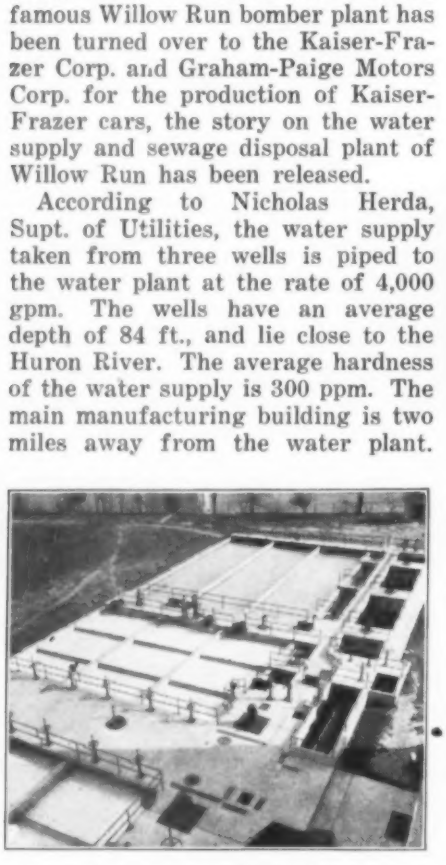
References

1. Anon. The Cause and Control of Sewage Plant Odors. The Digester 7, 6, Sept. 1941.
2. Starkey, R. L. A Study of Spore Formation and Other Morphological Characteristics of Vibrio Desulfuricans. Archiv. für Mikrobiologie 9, 268, 1938.
3. Thienes, Clinton H. Clinical Toxicology, p. 66. Lea & Febiger, Philadelphia, 1940.
4. Strahan, Joseph. Chlorination Eliminates Odors at Ocean Boardwalk Plant. Sewage Works Eng., 11, 142, Mar. 1940.
5. Reynoldson, T. B. The Biology of the Macro-Fauna of a High-Rate Double Filtration Plant at Huddersfield. Surveyor 99, 237, 1941.
6. Discussion. The Biology of the Macro-Fauna of a High-Rate Double Filtration Plant at Huddersfield. Surveyor 99, 271, 1941.
7. Heukelekian, H. H. Sewage Chlorination for Odor Control. Water Works & Sewerage 89, 302, 1942.
8. Rudolfs, Willem. Principles of Sewage Treatment. Bulletin No. 212. National Lime Association, Washington, D. C. 1941.
9. Hood, John W. Copper Sulfate as an Aid to Sewer Maintenance and Sewage Treatment. Water Works & Sewerage 89, 121, 1942.
10. Hommon, C. Control of Odorous and Destructive Gases in Sewers and Treatment Plants. Water Works & Sewerage 89, 277, 1942.
11. Hurst, D. H. Use of Caustic Soda on Trickling Filters. Public Works 75, 30, May 1944.
12. Dedmon, W. W. Scum and Odor Experiences at Cherryville Treatment Plant. Municipal Sanitation 9, 258, 1938.
13. Orford, Harold E., and Scharch, Ellis T. Activated Carbon Reduces Odors and Scum at Medina, Ohio. Municipal Sanitation 9, 124, 1938.
14. Carr, Kenneth L. Activated Carbon as a Means of Controlling Odors and Sludge Stability at the Rockford, Michigan, Sewage Treatment Plant. Taste and Odor Journal 5, No. 7, 1-2, Mar. 1939.
15. Anon. "Gas-Mask" Ends Odors for Sewage. Municipal Sanitation 11, 212, 1940.
16. McLean, D. L., and Laidlaw, Gordon C. Sewage Odor Control at Winnipeg. Eng. Contract Record 55, 32, 1942.
17. Brownell, George T., and Woodhams, Walter J. Treatment of Sewage with Ozone. U. S. Patent 2,249,739, July 22, 1941.
18. Various Experiences in Odor Control. Sewage Works Journal 13, 956, 1941.
19. Round Table. Handling Three Nuisances: Flies, Pooling and Weeds. Sewage Works Eng., 11, 91, Feb. 1940.
20. Agar, C. C. More Experiences in Odor Control. Sewage Works Journal 13, 1231, 1941.
21. Lloyd, L. L., Graham, J. F., and Reynoldson, T. B. The Fauna of the Sewage Bacteria Beds. Sewage Works Journal 12, 646, 1940.
22. Fisher, A. J. The Status of Biofiltration. Water Works & Sewerage 89, 416, 1942.
23. Murray, K. A. The Control of Filter Flies on Percolating Filters. Sewage Purif., 2, 21, 1940.
24. Murray, K. A. The Control of Filter Flies on Percolating Filters. Sewage Purif., 2, 212, 1940.
25. Wisely, W. H. Sewage Plant Operation, p. 38, Sewage Works Engineering, New York, 1937.
26. Spencer, Herbert; Hedden, Julius C., and Dworsky, Leonard B. Destruction of Housefly Larvae and Pupae in Sewage Sludge Beds. Public Works 73, 17, 1942.

WILLOW RUN TREATS ALL WATER, SEWAGE AND INDUSTRIAL WASTES

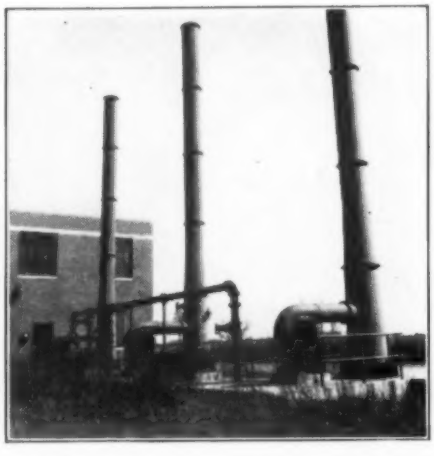
Now that the war is over and the famous Willow Run bomber plant has been turned over to the Kaiser-Frazer Corp. and Graham-Paige Motors Corp. for the production of Kaiser-Frazer cars, the story on the water supply and sewage disposal plant of Willow Run has been released.

According to Nicholas Herda, Supt. of Utilities, the water supply taken from three wells is piped to the water plant at the rate of 4,000 gpm. The wells have an average depth of 84 ft., and lie close to the Huron River. The average hardness of the water supply is 300 ppm. The main manufacturing building is two miles away from the water plant.



Water Softening Plant

Softening with lime in coagulation basin; settling tanks in rear.



Willow Run Disposal Plant Neutralizes Waste Acids

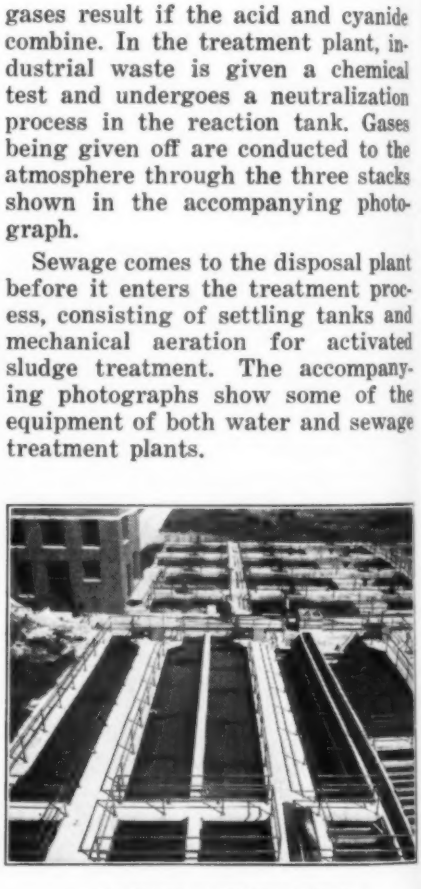
Three 25 ft. chimneys serve as exhaust pipes for reaction tanks at the industrial waste disposal plant. Acids and cyanide solutions come from plating rooms at 300,000 gpd. rate.

The hardness of the water is reduced from 300 to 62 ppm. by lime treatment. Filtration and chlorination are used to safeguard the water supply.

Sewage and Waste Treatment

Two sewer lines of non-corrosive acid resistant character transport some 300,000 gpd. of acids and cyanide solutions to the industrial waste treatment plant. The dual pipeline system was set up because deadly gases result if the acid and cyanide combine. In the treatment plant, industrial waste is given a chemical test and undergoes a neutralization process in the reaction tank. Gases being given off are conducted to the atmosphere through the three stacks shown in the accompanying photograph.

Sewage comes to the disposal plant before it enters the treatment process, consisting of settling tanks and mechanical aeration for activated sludge treatment. The accompanying photographs show some of the equipment of both water and sewage treatment plants.



Activated Sludge Plant

Mechanical aerators in rear; settling tanks in foreground.

WHY HIGH RATE FILTERS WORK

A Few Speculations and Some Deductions

By JOHN R. DOWNES
Superintendent
JOINT SEWAGE TREATMENT WORKS,
PLAINFIELD, N. J.

I HAVE listened to, and read, numerous papers on high rate sprinkling filters. These papers have, for the most part, apparently been designed to point out the superiority of one type of filter over another, but if anyone has pointed out why these high rate-high capacity filters accomplish what they do I have missed it.

I think that the answer may be expressed in two words—namely, "Maintained Equilibrium."

The good old standard rate filters, partly from the precedent of intermittent sand bed practice and partly from the necessity of accommodating the design to a wide range of flow and loadings, have always been operated intermittently. This system provided alternate feasts and famines for the biological population as well as erratic flood and drought periods. Distribution was bad at its best, as can be proved by observation of variations in the distribution of growths on the surface of low rate filters.

Somewhere between the feast and the famine, between the flood and the drought, there are some areas and points of time where and when optimum conditions are provided for the useful biological population on the filter media.

Plainfield Experience

At the Plainfield, N. J., plant the primary object of long used recirculation of a portion of the effluent has been elimination of the psychoda fly nuisance, and in this objective we have been very successful indeed. Incidentally, we have greatly increased the capacity and effectiveness of the filters thereby. However, by such practice our filters do not, by any stretch of imagination, come into the "high rate" class. We have, nevertheless, taken the opportunity to analyse the causes of the improvement in operating results obtained

The Author
Longtime Champion of the Trickling Filter

as the result of effluent recirculation and the more nearly continuous and uniform application of the settled sewage.

Observation of the variations in surface growths about any individual nozzle of low rate filters will indicate unevenness of distribution which precludes the possibility of optimum conditions for growth of any one organism on more than a very small portion of the surface of the filter. Comparable conditions must exist to a lesser degree throughout the depth of the filter.

At the Plainfield plant special nozzles were installed to provide a finer spray, giving maximum surface coverage and distribution. The total capacity of this nozzle field was determined to be 7 MGD. under heads continuously varying from zero to six feet on a 32 second cycle, maintained by means of an electrically operated butterfly valve. Sufficient recirculation of effluent is maintained to supply the 7 MGD. nozzle field capacity regardless of rate of sewage flow.

The above program provides:

(a) maximum coverage of surface area.

(b) nearest possible approach to uniformity of distribution.

(c) any failure to accomplish (b) in full is compensated for at least to a large extent by thorough mixing of the returned filter effluent with the primary effluent applied to the nozzle field.

(d) satisfaction of much of the immediate oxygen demand of primary effluent by the returned oxidized filter effluent which contains nitrites and nitrates.

(e) recirculation further aids in securing even distribution of the oxygen demand load.

(f) the hour to hour fluctuations in the incoming BOD load are somewhat leveled off, cutting the crests and valleys and restraining fluctuations to limits within which desirable organism communities can establish an optimum population ceiling.

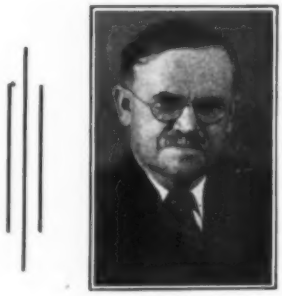
(g) the steady optimum diet (freed from the feast and famine swings, and evenly distributed) maintains a ceiling population of biologic "specialists" throughout the filter film, while the steady uniform flushing operation of the constant flow provides an optimum sewage disposal system, continuously carrying off toxic end products from the community. The community is, thereby, freed from the periodic disrupting incursions of scavenger groups of organisms and the well known "unloading" periods of the low rate filter.

Thus the film population of specialists is organized and established on a stepped up streamlined production basis, concerned only with its main objective of self propagation. The accelerated oxidizing phenomenon incident to this effect is, of course, what we are most interested in.

The above speculative deductions would seem to this writer as the most plausible explanations as to the reason why high-rate filters can handle such remarkable sustained organic loadings without breakdown or any appreciable depreciation in efficiency.

WEATHER CYCLES AND THEIR CAUSES

By HALBERT P. GILLETTE
President
THE GILLETTE PUBLISHING CO.



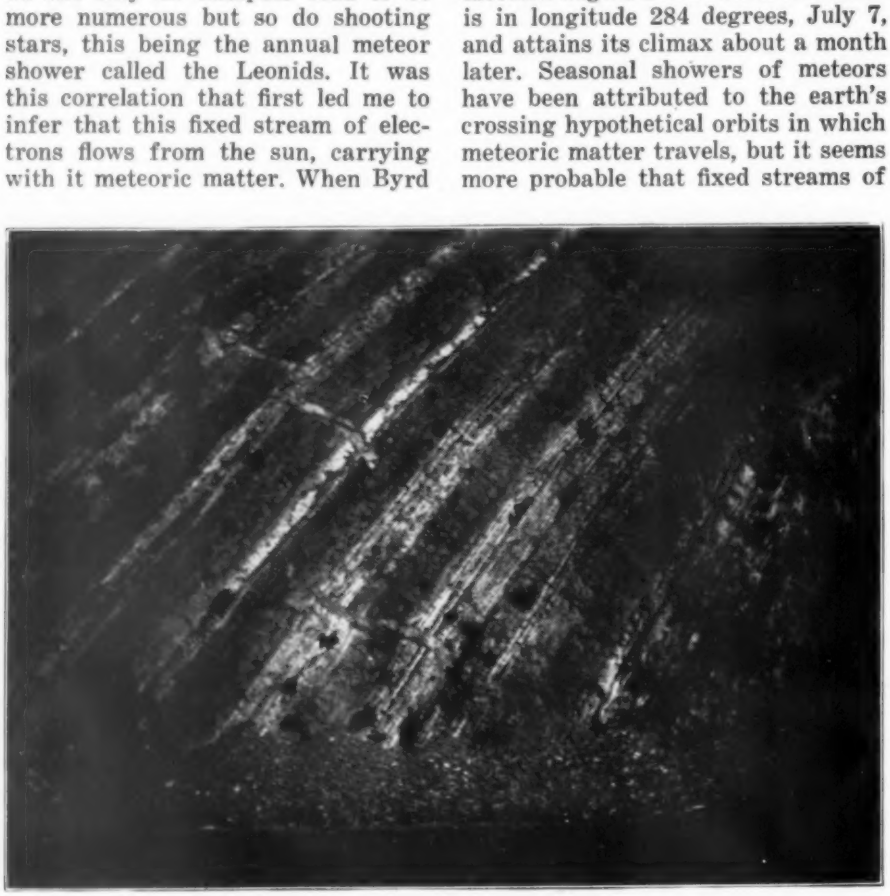
The Author

IN the December, 1942, issue of *Water Works & Sewerage* I announced that when the planets are in heliocentric longitude 288 degrees they tend to produce an abnormal number of sunspots; from which it was inferred that they then cross a stream of galactic electrons flowing sunward. Subsequent study has shown that stream to have its center in longitude 284 degrees, which the earth crosses July 7; and that the stream of electrons flows out of the sun. It is significant that the sun's south pole is 120 degrees from 284 in longitude 164 degrees, and that there is another stream of solar electrons in that longitude the center of which the earth crosses March 6, at which time both sunspots and auroras tend to be more numerous. There is another strong stream of solar electrons 120 degrees from 164 whose center is longitude 44 degrees, which the earth crosses November 8. On November 10 to 14 not only do sunspots tend to be more numerous but so do shooting stars, this being the annual meteor shower called the Leonids. It was this correlation that first led me to infer that this fixed stream of electrons flows from the sun, carrying with it meteoric matter. When Byrd first spent a winter in Antarctica, he saw about 10 times as many meteors as he had ever seen in the same length of time. Since his camp was not far from the south magnetic pole, I infer that spiralling solar electrons attracted by that pole bring meteoric matter. It is significant that Schwabe, the discoverer of the "11-year" sunspot cycle, noticed that meteors tend to be abnormally numerous near sunspot peaks.

The longest annual shower of meteors begins about when the earth is in longitude 284 degrees, July 7, and attains its climax about a month later. Seasonal showers of meteors have been attributed to the earth's crossing hypothetical orbits in which meteoric matter travels, but it seems more probable that fixed streams of solar electrons bring such matter into our atmosphere. Evidence of this will be presented in a forthcoming book on Cycles.

Monthly sunspot numbers do not give very satisfactory evidence of the effects of planets on the sun; whereas daily sunspot numbers show that when Mercury, Venus, Earth and Mars are in heliocentric longitudes 284, 44 and 164 degrees there are, on the average, abnormal numbers of spots, the greatest number being when the planets are in longitude 284. Rainfall tends to increase when a planet is in those longitudes and this applies to all the planets with the possible exception of Pluto.

Intermediate between those longitudes that are 120 degrees apart the longitudes 40 degrees apart evidently mark centers of weaker streams of solar electrons, for when a planet is in those longitudes, rainfall tends to increase, but to a less degree. There is similar evidence of lesser streams of electrons 40/3 or 13.33 degrees apart, and 40/9 or 4.44 degrees apart, and so on. The result is that each planet tends to cause a series of rain cycles, each cycle having a length 3 times that of the next shorter one. I had found and published evidence of such triple-progression series of cycles several years before the cause became evident.



Paired Beds of Calcareous and Argillaceous Mudstone that Record the 603 Year Climatic Cycle Caused by Planet P.

Periods of the Planets

The planet Uranus is assigned an orbital period of 84.01529 years in the American Ephemeris; yet it was discovered so recently (1781) that it is unlikely that its period is known with any such accuracy as the string of decimals indicates. Should its period be exactly 84 years it might so harmonize with that of the earth that both would be in heliocentric longitude 284 degrees at the same time. On July 7, 1908, when the earth was in that longitude, Uranus was there also.

Saturn's period is given as 29.45772 years, but since 324/11 is 29.45455, it seemed to me likely that Saturn makes 11 revolutions while the earth makes 324. This was partly confirmed upon finding it lacked only 5 days of being in longitude 284 degrees on July 7, 1636.

In like manner, the lengths of the orbital periods of other planets

were assumed to be exactly harmonic with the earth's period. Table 1 gives the assumed lengths of each harmonic period, followed by the observed length as given in the Ephemeris. Table 2 gives a date when a given planet and the earth were very nearly in heliocentric conjunction in longitude 284 degrees. Slight departures from exact conjunction are attributable to perturbations, some of which are caused gravitatively;

TABLE 1

Lengths of Orbital Periods of Planets

Cycle Series	Planet	Harmonic Period	Ephemeris Period
A & N	Mercury 46/191=	0.24083	0.24085
E & M	Venus 243/395=	0.61519	0.61521
D & K	Mars 79/ 42=	1.88095	1.88089
G & J	Jupiter 95/ 8=	11.86250	11.86223
H & I	Saturn 324/ 11=	29.45455	29.45772
F	Uranus 84/ 1=	84.00000	84.01529
B	Neptune 165/ 1=	165.00000	164.78829

(Uranus was discovered in 1781; Neptune in 1846. Table 2 gives lengths and peak dates of weather cycles caused by these planets.)

others, I believe, magnetically. Streams of solar electrons that are affected magnetically by a planet must cause slight orbital perturbations, which hitherto have received no recognition.

The peak dates in the last column of Table 2 were calculated in advance, as above shown, then search was made for sunspot, rainfall, tree-ring and varve cycles having those peak dates. The finding of these cycles constituted confirmation of the theory.

Varves are layers of sediment deposited annually in lakes or seas. The longest, unbroken series of varve measurements in a core from an existing lake bed, (Lake Saki, Crimea) is that published by Schostakowitsch in 1935. It goes back nearly to 2300 B.C., or 1000 years earlier than the oldest tree-ring. Cycles found in those varves were found also in Ice Age varves. These were measured by Ernst Antevs in the Connecticut River valley, forming an unbroken series of 3350 years. By finding a cycle in those Ice Age varves, their dates were determined: e.g., the varve number 4400 was deposited 15,001 B.C. By dating those Ice Age varves no doubt is left as to the correctness of the assumption in Table 1 that all orbital periods of planets are commensurable with that of the earth, and harmonic therewith.

Weather Cycles

The lengths of most of the cycles in Table 2 have been found approximately by other researchers, but usually with errors of 2 or more per cent. At least 17 men have reported weather cycles of 32 to 37.5 years, beginning with Sir Francis Bacon who, in 1626, called it 35 years. Bruckner (1890) assigned an average length of 34.8 years to it, although previously he and Fruh had called it 32 years. Table 2 shows that there is a cycle of exactly 31⅔ years due to the combined effects of Jupiter and Earth, and one of exactly 36 years due to Saturn and Earth. One of the commonest mistakes has been failure to recognize the existence of two or more distinct cycles differing but a few per cent in length. Fortunately there is only one series of cycles, Series C, having lengths exceeding 324 years.

According to an ancient Scotch proverb, "Leap year was ne'er a good sheep year," because of its tendency to be cold and wet. The 4-year cycle turns out to be a subcycle of the 36-year cycle, both having peaks when Saturn and Earth are crossing a stream, but not necessarily the same stream of solar electrons. Orbital eccentricity does not prevent cooperation of the earth with other planets in causing the subcycles in Table 2.

In a previous article it was shown that electrons emitted around the axes of cyclonic sunspots have the same direction of whirl as that of the sunspot, and consequently have the magnetic polarity of the sun's hemisphere whence they escape. Hence they are magnetically attracted by magnetic foci in the opposite hemisphere of the earth. This explains several anomalies, notably that mere numbers of sunspots, without distinction as to hemisphere, are not a criterion as to the amplitudes of a weather cycle caused by them.

How Solar Electrons Produce Weather Disturbances

Weather disturbances are caused by influxes of solar electrons in five ways: (1) by generation of atmospheric currents in accordance with Faraday's principle of magnetic rotation of electric currents; (2) by the tendency of electrons to cause condensation of atmospheric moisture, in accordance with Wilson's principle; (3) by increased windiness, which increases oceanic evaporation and rainfall; (4) by increased evaporation due to increased electronic charge of water; and (5) by reduced influx of solar heat, due to reflection of radiant waves by atmospheric electrons, and to absorption and scattering by atmospheric moisture.

During the last Ice Age, about 20,000 years ago, land-locked lakes increased greatly in area. As shown by raised beaches, California's Mono Lake and Owens Lake had three times their present areas befor overflow began. That indicates annual rainfall about three-fold what it has averaged in recent years. I infer that the last overflow, and consequent freshening, of those lakes occurred near the last rainfall peak of the 16,281-year cycle about 2300 B.C., for Gale (1914) found that at the then existing rate of delivery of chlorine in salts by Owens River, Owens Lake had accumulated its chlorine in about 4000 years. Similar calculations by J. Claude Jones (1925) give about the same length of time since Pyramid Lake, Nevada, was fresh; and by Walton Van Winkle (1914), since Albert and Summer Lakes, Oregon, were fresh. About the same time (2300 B.C.) flood levels of the Nile,

TABLE 2

Lengths of Cycles in 14 Triple-Progression Series

Series	Years	Years	Years	Years	Years	Years	Years	Peak July 7
A	...	...	46	15.33	5.11	1.70	0.57	1928
B	...	165	55	18.33	6.11	2.04	0.68	1826
C	603	201	67	22.33	7.44	2.48	0.83	1883
D	...	...	79	26.33	8.78	2.93	0.98	1907
E	...	243	81	27.00	9.00	3.00	1.00	1868
F	...	...	84	28.00	9.33	3.11	1.04	1908
G	...	...	95	31.67	10.56	3.52	1.17	1913
H	...	324	108	36.00	12.00	4.00	1.33	1636
I	...	...	...	29.46	9.82	3.27	1.09	1852
J	...	...	...	....	11.86	3.95	1.32	1913
K	...	...	...	....	....	1.88	0.63	1907
L	...	...	...	....	....	1.00	0.33	....
M	...	...	...	....	....	0.62	0.21	1842
N	...	...	...	....	....	0.24	0.08	1928

Note: The peak date of every cycle in a series is that in the last column on July 7 of the given year. The peak is that of maximum influx of solar electrons; and is usually a cold-wet peak, but in certain regions at times it is a warm-dry peak, the phase being reversed. Peaks are often marked by disturbances of the earth's crust. With the exception of Series C, no series has a cycle longer than is given in this table; but in Series C there are cycles 3, 9, 27, 81, etc., times 201 years in length. The cycle of 81×201 or 16,281 years had its last cold-wet peak 2338 B.C., which was also a peak of all the subcycles of Series C. Its previous peak, 18,619 B.C., was a peak of the Glaciation Cycle whose length is $9 \times 16,281$ or 146,529 years. The Glaciation Cycle has had three peaks in the Quaternary Age, the first being 311,677 B.C., at the very beginning of the Quaternary Age. The cycle called a Geological Period has a length 9 times that of the Glaciation Cycle, and its last peak was at the beginning of the Quaternary Age. Each series has cycles shorter than the shortest given above. For example, Series B has a cycle of 27.57 days, and cycles 1/3 and 1/9 of that length.

scribed in the rock walls above the Second Cataract, were about 23 ft. above the highest floods of modern times; and a long period of great prosperity occurred in the Mediterranean region, as indicated by building pyramids in Egypt and monumental palaces in Crete. Then, also, began the Bronze Age which lasted some 1800 years till near the peak of the 1809-year climatic cycle about 500 B.C. when the Iron Age began in Europe.

In a given series of Table 2, the longer a cycle the greater its amplitude or departure from a mean. Amplitudes vary systematically, being least when a short cycle occurs at a valley, and greatest when at a peak of a long cycle of the same series. Near the valley of a very long cycle the amplitude of a short cycle may be so slight as to be scarcely noticeable. This may cause an illusion of entire disappearance of the short cycle, which has so often puzzled researchers.

Why 1944 and 1945 Were Wet Years

The 67-year cycle of Series C will have its next cold-wet peak in 1950. Its effect has been seen in recent years, notably in the very wet year of 1945 when the 31⅔-year cycle had a peak that was assisted by the 9⅓-year and shorter cycle peaks in that year, and by the 18⅓-year cycle peak in 1944. The effect of a peak of a long cycle extends over several years. For example, there were many dry years before and after 1783 which was the last dry peak of the 201-year cycle. Although its next dry peak will not occur till 1984, a downward trend in rainfall and upward trend in temperature has been evident in many regions; relieved, of course, by the opposite effects of short cycles. A noteworthy reversal of that trend will reach its maximum between 1950 and 1960, the latter date being a peak of the 324-year cycle.

It should be remembered that "permanent" anticyclones are strongest about the times that "permanent" cyclones are strongest, namely during abnormal influxes of solar electrons. Hence a region that is "blanketed" by a "permanent" anticyclone may become abnormally dry when other regions become abnormally wet.

Neptune's Short Cycle

It has been objected to the theory of streams of solar electrons that mutual electrical repulsion would cause scattering of the electrons; but objectors overlook the fact that electrons having a component of motion in the same direction attract one another magnetically. That attraction increases with the velocity. There is evidence that the velocity of emitted solar electrons is that of light. In consequence of the coherence of solar electron streams, there is little decrease in their effects even at distances from the sun vastly greater than that of the earth. Neptune is 30 times as far from the sun as is Earth, yet it causes weather cycles of outstanding amplitude. Its subcycle of 2.04 years, or, more exactly, 24.44 months, is often seen in alternately wet and dry years. At least a score of researchers have reported a weather cycle of about that length. There has been much speculation as to its cause.

In Table 2 the cycles of Series C have no known planet as a cause. The cycle of 22⅓ years is double the length of the most outstanding sunspot cycle, the one discovered by a German apothecary, Schwabe, about a century ago. Only alternate peaks of Schwabe's spot cycle are ordinarily accompanied by much rainfall in the northern hemisphere. The reason for this is that sunspot numbers are usually greater in the southern hemisphere, and notably so near peaks of the longer cycles of Series C. In the footnote of Table 2 some of the longest cycles of Series C are given, along with their peak dates.

Newton's second research rule is: "In as far as possible, the same causes are to be assigned for the same kind of natural effects." This leads to the inference that the cycles of series C in Table 2 probably are caused by a planet as yet unseen. That the 603-year cycle is caused by such a planet is well supported by perturbations of Uranus when it is near the longitude of a planet moving in a nearly circular orbit, which planet was in longitude 284 degrees in 1883 when the cold-wet peak of the 603-year cycle occurred.

William H. Pickering's article in *Popular Astronomy*, Aug-Sept., 1931, shows two major perturbations of Uranus which he attributed to a massive planet having a highly inclined (37 deg.), eccentric (0.27) orbit, and a period of 656 years. Since the weather subcycles of the 603-year cycle closely resemble in regularity those caused by Neptune, Uranus, Saturn and Jupiter, I infer that the planet that causes them has a nearly circular orbit near the "invariable plane." If so, its longitude will be about 322 degrees during the latter half of 1946. Such a planet would fit quite well Bode's law of mean distances from the sun, for its distance would be nearly 72 times that of the earth.

The experimental discovery of the electron by Sir J. J. Thomson in 1897 has revolutionized several branches of physics. It seems destined to have revolutionary effects in meteorology, geology and astronomy.

A few weeks hence reprints of a forthcoming article on "Geological Evidence of Cycles" will be available, copies of which will be sent upon request if addressed to the writer at 330 S. Wells St., Chicago 6, Ill.

Annual Report, St. Louis, Mo.

The Annual Report of the Water Commissioner of the City of St. Louis for the fiscal year ending April 9, 1945, prepared under the direction of E. E. Easterday, Water Commissioner, contains at least two items of pertinent interest to water works managers throughout the country.

For one thing, the non-revenue producing water consumption was reduced from 20 per cent of the total consumption to 11 per cent of the total consumption. At the same time the average daily consumption was 149.7 million gallons, an increase of 3.6 MGD. over the previous year, and the highest pumpage yet recorded.

The other interesting statement is that although $7,500,000 in Water Works bonds were authorized by the voters in 1944 for post-war construction of water works improvements, it is doubtful if any of these need ever be sold. An estimate of water works income for the next six years indicates that by 1950 the water works will be free of debt, whether or not the modernization is completed in that time. By 1951 sufficient funds should be on hand to complete the modernizing job and make a substantial reduction in water rates. If this estimate of water works income holds true, water bills in 1951 and thereafter can be discounted at least 50 per cent. Truly this is a record of good management of which the City of St. Louis can well be proud.

Call for Catalogs

The Veterans Administration Construction Service, Branch Office No. 4.—900 N. Lombardy St., Richmond, Va., desires to receive catalogs of water and sewage works equipment and materials from the manufacturers of such.

THE HAZEN-WILLIAMS HYDRAULIC SLIDE RULE

Instructions for Its Use

THIS is a slide rule designed by Professor Gardner S. Williams, of Cornell University, and Mr. Allen Hazen, of New York, to compute the flow of water in pipes and channels. The most commonly used formula for determining the velocity of flow of water in pipes and channels is the Chezy formula, namely, $v = c\sqrt{sr}$, where v is the velocity in feet per second, s is the hydraulic slope, r the hydraulic radius in feet, and c is a factor, the value of which is an approximation to a constant, but depends upon the roughness of the pipe and upon the hydraulic radius and slope. The variations of c are considerable and make difficult the general use of the formula.

Kutter's formula was devised to compute the value of c in the Chezy formula. The value of c so computed depends upon an assumed coefficient of roughness, upon the slope and upon the hydraulic radius. With the same degree of roughness the value of c increases with the hydraulic slope and with the hydraulic radius. This is because the exponents used for them in the formula are below the true values. If the exponents were increased to correspond more nearly with the facts, the variation of c would become less. If exponents could be selected agreeing perfectly with the facts the value of c would depend upon the roughness only, and for any given degree of roughness c would then be constant. It is not possible to reach this actually, because the values of the exponents vary with different surfaces and also their values may not be exactly the same for large diameters and for small ones nor for steep slopes and for flat ones. Exponents can be selected, however, representing approximately average conditions, so that the value of c for a given condition of surface will vary so little as to be practically constant. Several such "exponential" formulas have been suggested. These formulas are among the most satisfactory yet devised, but their use has been limited by the difficulty of making computations by them.

The difficulty with the factional exponent can best be overcome by the use of a slide rule constructed for that purpose. Such a slide rule has been constructed to determine the velocity by the formula $v = cs^{0.54}\, r^{0.63}\, 0.001^{-0.04}$. The exponents in this formula were selected as representing as nearly as possible average conditions as deduced from the best available records of experiments upon the flow of water in such pipes and channels as most frequently occur in waterworks practice. The last term, $0.001^{-0.04}$, is a constant, and is introduced simply to equalize the value of c with the value in the Chezy formula, and other exponential formulas which may be used, at a slope of 0.001 instead of at a slope of 1.

In size and general appearance the rule is like an ordinary Mannheim 10-inch slide rule. It has an improved back which will prevent warping. The upper scale on the rule marked No. 1, and the upper scale on each side of the slide, marked No. 2 and No. 5, are like those on the Mannheim rule. One face of the slide is marked V (for velocity) at the right-hand end and contains scales No. 3a and 3b. Scale 3a, in the middle of the slide, gives hydraulic radii for channels and conduits. Scale 3b, on the lower edge, is graduated for the hydraulic radii of pipes and is marked with diameters in inches. The other side of the slide is marked Q (for quantity) at its right-hand end and contains scales No. 6a and No. 6b, marked for diameters in inches. The lower scale No. 4, on the rule is graduated for slopes in feet per thousand. On the back of the rule are several tables to aid in the convenience of computations to which the rule is applicable.

> Our attention has been directed to the fact that there are a number of the useful Hazen-Williams Hydraulic Slide Rules in existence, but in many instances the original booklet of instructions for their use has been lost, or maybe is in bad condition.
>
> It has been suggested that *Water and Sewage Works* reprint these instructions for the benefit of those who no longer have them available. This we are glad to do and hope that any reader who knows the owner of a Hazen-Williams Slide Rule will call his attention to the availability of these instructions.
>
> Should any of our readers desire one of these very useful H-W Hydraulic Slide Rules, *Water and Sewage Works* will, upon request, be glad to assist in securing one.—L. H. E.

Methods of Use

To Compute Velocity: Put the slide in the rule with the side up having V at the hight-hand end. Move the slide so that the diameter of the pipe in inches on scale No. 3b will be over the slope on scale No. 4. In case the channel is not circular in form, compute the hydraulic radius in units of one foot, not inches, and, with the aid of the marker, bring this on scale No. 3a over the slope.

Determine from the table on the back of the slide rule, or otherwise, the value of c to be used. Find this value upon scale No. 2. Opposite to it on scale No. 1 will be found the velocity in feet per second. This procedure gives the numerals in the velocity but does not give the position of the decimal point. To find the position of the decimal point, consult the table on the back of the rule, showing the velocities in feet per second for various sizes of pipe and slopes with $c = 100$. Enough values are given in this table to enable the position of the decimal point to be determined by inspection. If the velocity is known and the value of c is to be determined, the rule is set as above described and the value of c, on scale No. 2 found under the observed velocity. By a similar procedure the slope or diameter can be computed for a given velocity on scale No. 1 with a known or assumed value of c.

To Compute Quantity: To compute the quantity, reverse the slide so that the side is up which has Q on the right-hand end. Bring the diameter of the pipe, scale No. 6a or No. 6b, over the slope in scale No. 4. Determine from the table on the back of the rule, or otherwise, the value of c to be used. Find this upon scale No. 5, and opposite it in scale No. 1 will be the quantity in American gallons per 24 hours. As before, the numerals are given, but not the position of the decimal point. To find the position of the decimal point, or the number of ciphers to be added, consult the table for that purpose on the back of the rule. The position of the point can be determined by inspection.

To obtain the results in gallons per hours, gallons per minute, cubic feet per second, or any other units, multiply or divide the result obtained on scale No. 1 with the aid of scale No. 2. If a considerable number of computations are to be made, in which the results are required in the same unit other than gallons per day, a special value of c can be found which will give directly the desired result at one operation.

In case the pipe is more than 86 inches in diameter (that being the largest diameter shown on the scale) divide the actual diameter by 2.4; find the discharge corresponding to the new size, and multiply the result by 10. Or, divide the diameter by the square of 2.4, namely, 5.76, and multiply the result by

100. To find the discharge of pipes less than 2.7 inches in diameter (that being the smallest size shown on the scale), multiply the diameter by 2.4; find the discharge corresponding to the new size, and divide the result by 10. Care must be exercised in extending the process to very small pipes, as for them the values of c may vary considerably from those used for larger pipes. To find the velocity or discharge for hydraulic slopes of more than 50 in 1,000, find the velocity or discharge for a slope that is one hundredth of the actual slope and multiply the result by 12.05.

Special Computations

Knowing the flow of water through a pipe or system of pipes produced by a given slope or head, to determine the corresponding flow at any other slope or head:

Find the slope or head for which the results are known on scale No. 4, and with the aid of the marker bring the figure in scale No. 2 or scale No. 5, corresponding to the equivalent discharge, over it. Other discharges will then be opposite other slopes or heads. The figures on the slope scale can be used for pounds pressure, feet of head, etc., and those on scale No. 2 or scale No. 5 can be used for the discharge in any units which may be employed. In doing this, decimal points on the scale may be neglected. The position of the decimal point in the final result can be controlled if necessary by taking off a number of intermediate approximate values.

Example: If 54 pounds pressure are required to overcome friction in a certain line of pipe when discharging 320 gallons per minute, how much pressure will be used in supplying 470 gallons per minute? Put marker on 54 on lower scale (say on 0.54 foot per 1,000). Bring 320 on No. 2 scale to marker, then move marker to 470 on same scale and find amount required on lower scale (1.1 foot per 1,000) 110 pounds pressure, which is the answer.

Knowing the discharge in a given size of pipe at a given slope, what size of pipe must be used to produce the same discharge for any other slope?

Have the quantity side of the slide up. Bring the known size over the known slope. Other sizes will then be found over the corresponding slopes. In case it is desired to compare sizes in scale No. 6a with sizes in scale No. 6b, it will be necessary to move the scale exactly its length, marking the first position of the end with the marker, as in multiplying on the lower scales of an ordinary slide rule when the operation runs off the scale.

To compute the discharge through a compound pipe, that is a pipe of larger diameter connecting with a pipe of smaller diameter, or a series of such pipes:

Assume some quantity of water. Compute the total friction of each part of the pipe, corresponding to that quantity, by multiplying the computed slope in that pipe by the length of pipe. The sum of these frictions will be the total friction with the assumed discharge. Place the marker at this head on the slope scale, and move the scale until the quantity assumed is opposite the marker, on scale No. 2 or scale No. 5; other corresponding quantities will then be opposite other heads on the respective scales.

Example: To find the discharge through a compound pipe consisting of 16,000 feet of 30 inch pipe, 5,500 feet of 24 inch pipe, and 8,700 feet of 36 inch pipe, when the total loss of head is 30 feet. The pipe being moderately old take c=100 and compute the losses of head first for a discharge of 10,000,000 gallons daily. The computation may be tabulated as follows:

Quantity	Diameter inches	Slope per 1000	Length feet	Head loss feet
10,000,000	30	1.72	16,000	27.50
10,000,000	24	5.05	5,500	27.80
10,000,000	36	0.71	8,700	6.18
Total loss of head for 10,000,000 gallons				61.48

Set marker on 61.48 on slope scale and bring 10 on No. 2 scale to it. Then move marker as desired, e.g., taking it to a loss of head of 30 feet we find the corresponding discharge to be 6.8 million gallons daily.

To compute the friction of a given amount of water flowing through two pipes of different diameters and different lengths, freely connected at each end:

Assume given loss of head between the two points of connection. Divide this head by the length of each line to determine the hydraulic slope of that line. Compute the discharges for that slope. The sum of the discharges for the two lines is the total discharge for that head. Bring this amount on scale No. 2 or scale No. 5 over the assumed head on the slope scale and then move the marker to the desired quantity, when it will show on the slope scale the desired head.

Allowance for loss of head at entrance and in curves:

Allowance for velocity heads and for extra friction in curves can be most accurately made separately, but allowance can be made with sufficient accuracy for most practical purposes by adding to the length of pipe, before computing the slope, such an amount that the friction of water passing through it would equal the velocity head, and the additional losses in passing curves. In general it may be assumed that it takes about two velocity heads to give the water in a pipe a given velocity, and approximately one is recovered when the water is discharged into a receptacle above the end of the pipe, leaving a net loss of one velocity head; and it may further be assumed that about one-quarter of a velocity head will be lost for each quarter bend of pipe. The allowance is therefore made by adding to the length of pipe that amount in which the friction is equal to the velocity head, and in addition, one-quarter of this amount for each quarter bend in the line of pipe. The lengths of pipe in which the friction is equal to a velocity head for a number of sizes and for two values of c are shown in a table on the back of the rule.

To get with one setting of the slide the quantity of water corresponding to any slope:

Have the quantity side of the slide up. Find the value of c in scale No. 5. Bring either end or the middle of scale No. 1 to it. Move the marker to the size of pipe on scale No. 6, and move either end, or the middle of scale No. 5 to it. If the marker is now put at any desired slope it will show on the scale No. 5 the corresponding quantity; or, set on the desired quantity, will show the required slope.

To get with one setting of the slide the quantities of water discharged by pipes of different sizes for a given slope and co-efficient:

Put the slide in with the Q side showing, but inverted. Bring the coefficient over the slope, and the quantities will appear directly over the respective pipe sizes.

Value of C

Some approximate values of c are given upon the back of the rule. There is much more detailed information upon this point in "Hydraulic Tables," by Williams & Hazen, published by John Wiley & Sons, New York, to which the reader is referred for many experimental results.

The values of c selected by the authors of this book, for a number of kinds of pipe, are as follows:

For cast iron pipe:

Age of pipe in yrs.	Diameter of Pipe in Inches 4	6	8	10	12	16	24	36	60
0	130	130	130	130	130	130	130	130	130
10	106	108	109	110	110	111	112	112	112
20	88	92	94	96	97	98	99	99	100
30	75	80	83	85	86	87	89	90	91
40	64	71	74	76	78	79	81	83	84
50	56	63	67	69	71	73	75	76	78

For steel pipe:

With lock bar joints, the same as cast iron pipe.

With double riveted joints, about the same as for cast iron pipe 10 years older, or about 112 for new pipe and 90 for pipe 10 years old.

Sewers—tile pipe, 110; brick, 100.

Masonry aqueducts, with very smooth sides, 125, but this will be reduced if the sides are not perfectly smooth or if the water forms deposits upon them.

For pipes of uncertain age and miscellaneous channels, as a basis of general calculations, use 100 most frequently.

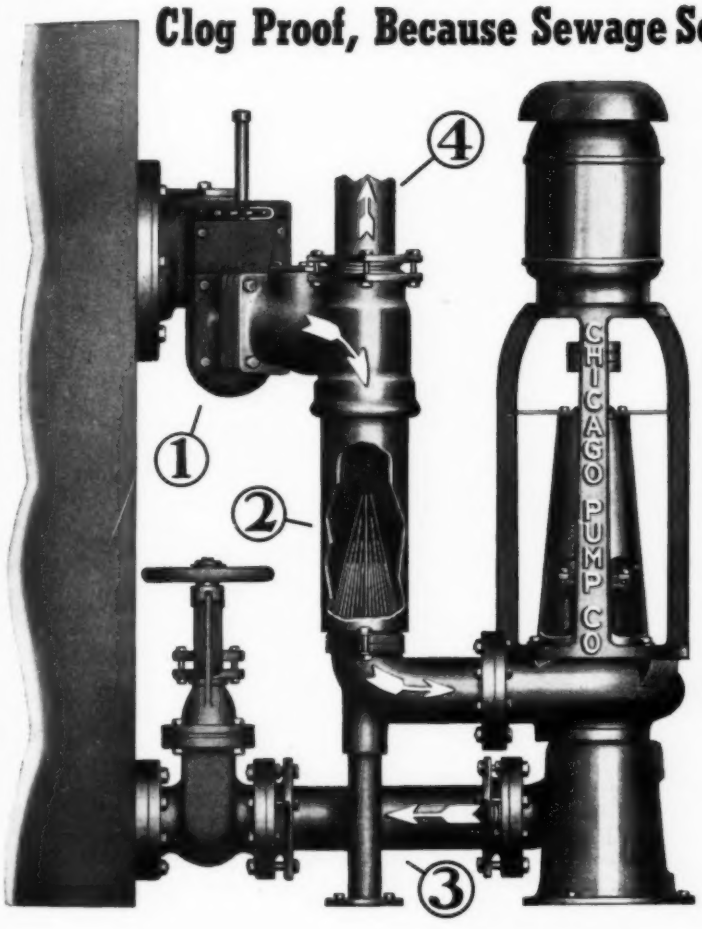
SEWAGE PUMP CLOGGING

SOLVED

....through intensive engineering application

with "FLUSH-KLEENS"

Clog Proof, Because Sewage Solids Do Not Pass Through Impellers



3,000 INSTALLED SINCE 1924

No labor required for disassembling and cleaning.

Most reliable pump made for sewage lift stations, because they require no attention, except periodic lubrication.

"Flush-Kleens" have longer life than other sewage pumps, due to the fact that no solids pass through impellers to throw the pumps out of balance and cause excessive strain and wear on impellers, casings, bearings, shafts, and motors.

Operation cost is less, because "Flush-Kleen" impellers handle water only. They cannot bind and put undue loads on the motors.

"FLUSH-KLEENS" Operate Alternately

Sewage flows into basin through idle pump.

FILLING WET WELL

① Sewage flows through inlet pipe.
② Sewage solids are retained by strainer.
③ Strained sewage flows through idle pump to basin.

PUMPING

③ Strained sewage is pumped from basin.
② Sewage solids are backwashed from strainer.
④ Special check valve closes; sewage and solids are pumped to sewers.

Complete Information in Bulletin 122.

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2349 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**

Flush-Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs, Water Seal Pumping Units, Samplers.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

KEEP SEWERS OPEN with OK CHAMPION POWER SEWER CLEANER

OPEN

CLOSED

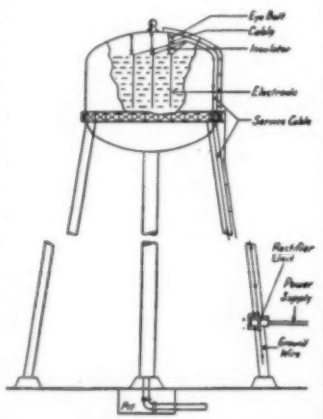
Town and City officials throughout America are adopting OK CHAMPION Power Sewer Cleaner to keep sewers clean and efficient. Takes roots, dirt, sand, and other debris up from main in one continuous operation. All men work above street level.

Pulling forward opens the jaws that bite into obstructions. Reversing the pull on the bucket automatically closes jaws which hold load pulled back to street level. Write for complete details.

CHAMPION CORPORATION 4718 SHEFFIELD HAMMOND, IND.

Permanent **PROTECTION** *against under-water* **RUST**

The Electro Rust-Proofing Cathodic System simply stops the electrolytic action which causes rust on submerged metal. It therefore stops rusting—instantly, permanently, economically. Kills the greatest cause of deterioration. Eliminates forever the costliest item of maintenance—draining, scraping, painting. Usually installed for about the cost of one paint job; operates year in and year out for a small fraction of ordinary painting cost. Used by thousands of municipalities and industries in water tanks, standpipes, flocculators, deep wells, and other water-handling equipment. Engineered to each installation. Advocated by independent authorities. Write for details, proof of performance, list of users.



ELECTRO RUST-PROOFING *Corporation*

DAYTON 10, OHIO, U. S. A.

MEETINGS SCHEDULED:

June 19—MANCHESTER, VT. (Equinox House)
New England Water Works Association. (Annual Outing). Sec'y, W. C. Conroy, 609 Statler Bldg., Boston, Mass.

June 20-21—AKRON, O. (Mayflower Hotel)
Ohio Conference on Sewage Treatment. Sec'y-Treas., L. B. Barnes, 441 So. Prospect St., Bowling Green, Ohio.

June 28—LITTLE FALLS, N. J.
New Jersey Section A.W.W.A. (Summer meeting) Sec'y, C. B. Tygert, Box 178, Newark, N. J.

July 25-27—BATON ROUGE, LA. (Louisiana State Univ.)
Ninth Annual Water & Sewage Short Course. Director, John H. O'Neill, Div. of Public Health Eng., P.O. Box 630, New Orleans 7, La.

Aug. 14—WOODLAND, ME.
Maine Water Utilities Association. Sec'y, Earle A. Tarr, Supt. Water District, Winthrop, Me.

Aug. 26-28——STATE COLLEGE, PENNA. (Nittany Lion Inn)
Pennsylvania Water Works Operators' Association. Sec'y-Treas., I. M. Glace, 1001 North Front St., Harrisburg, Pa.

Aug. 28-30—STATE COLLEGE, PENNA. (Nittany Lion Inn)
Pennsylvania Sewage Works Asso. Sec'y-Treas., Bernard S. Bush, Penn. Dept. of Health, Kirby Health Center, Wilkes-Barre, Pa.

Sept. 9-11—SAVANNAH, GA. (DeSoto Hotel)
Southeastern Section A.W.W.A. Sec'y, B. P. Rice, Healey Bldg., Atlanta 3, Ga.

Sept. 12-13—SANTA FE, N. MEX. (La Fonda Hotel)
Rocky Mountain Section A.W.W.A. Sec'y-Treas., O. J. Ripple, Supt. of Filtration, R.F.D. 2, Littleton, Colo.

Sept. 12-13—PITTSBURGH, PA. (Hotel Roosevelt)
Western Penna. Section A.W.W.A. Sec'y-Treas., E. P. Johnson, 418 Flannery Bldg., Sta. 13, Pittsburgh, Pa.

Sept. 16-18—ATLANTA, GA. (Georgia School of Technology)
Georgia Water & Sewage School. (15th Annual) Sec'y, Van P. Enloe, Box 363, R.F.D. No. 5, Atlanta, Ga.

Sept. 17-20—POLAND SPRING, ME. (Poland Spring House)
New England Water Works Assn. (Annual Meeting). Sec'y, W. C. Conroy, 609 Statler Bldg., Boston, Mass. (On Sept. 16, a pre-convention get-together will be held in the evening.)

Sept. 18-20—TRAVERSE CITY, MICH. (Park Place Hotel)
Michigan Section A.W.W.A. and Conference on Water Purification. (Joint Conference.) Sec'y-Treas., R. J. Faust, Michigan Dept. of Health, Lansing, Mich.

Sept. 22-25—FORT WORTH, TEXAS (Hotel Texas)
American Public Works Congress. Exec.-Dir., Norman Hebden, 1313 East 60th St., Chicago 37, Ill.

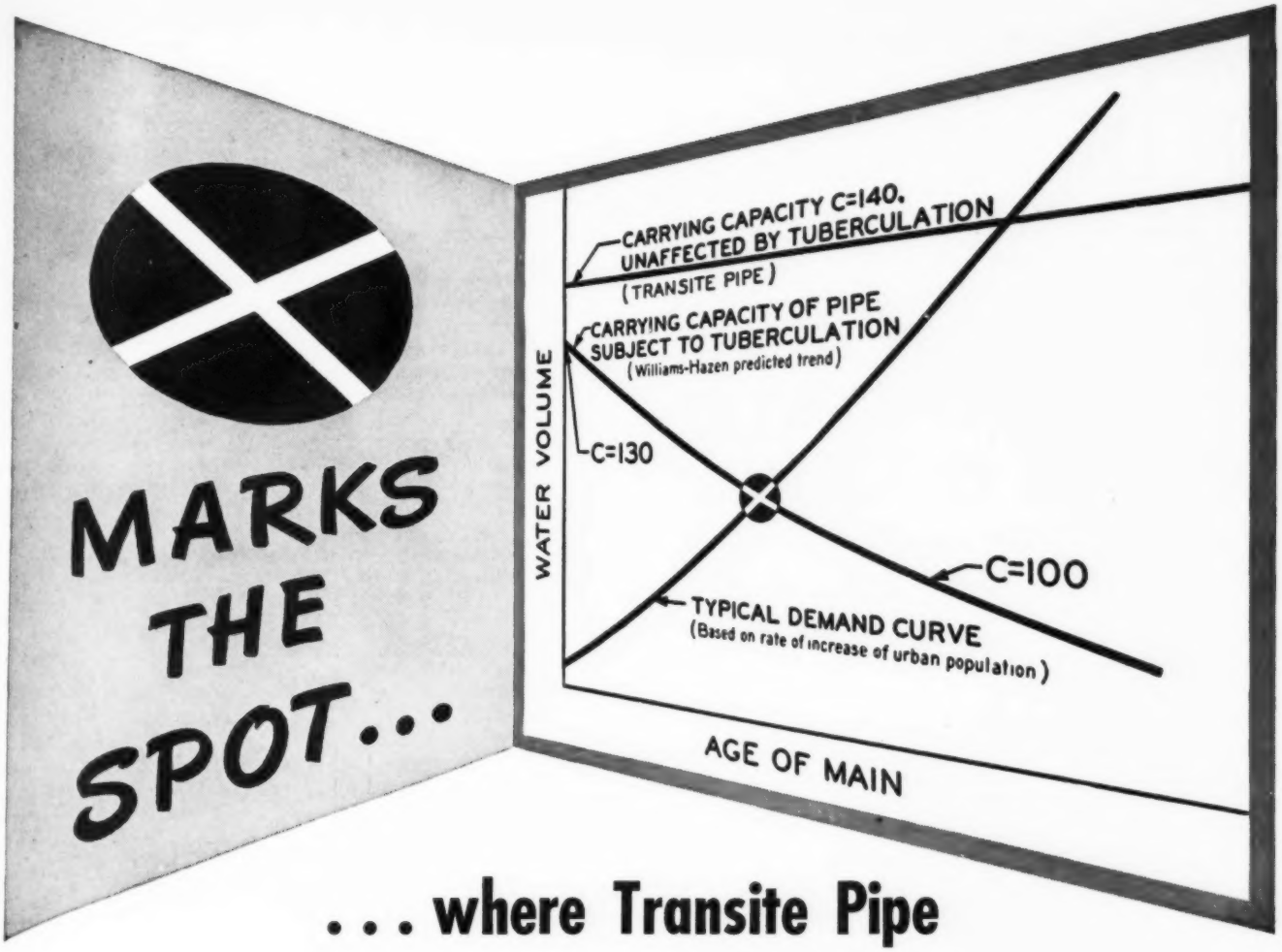
Sept. 27-28—
Four States Section A.W.W.A. Sec'y-Treas., H. Lloyd Nelson, 1624 Lincoln-Liberty Bldg., Philadelphia 7, Pa.

Oct. 3-4—ALBANY, N. Y. (Hotel DeWitt Clinton)
New York Section A.W.W.A. Sec'y Treas., R. K. Blanchard, 50 West 50th Street, New York, N. Y.

Oct. 7-9—TORONTO, CANADA (Royal York Hotel)
Federation of Sewage Works Assns. Exec.-Sec'y, W. Wisely, 625 Illinois Bldg., Champaign, Ill.

Canadian Institute of Sewage & Sanitation. Sec'y-Treas., Dr. A. E. Berry, Parliament Bldgs., Toronto, Ont.

(*Continued on page* 108)



. . . where Transite Pipe means extra savings for taxpayers

THE CURVES above help explain why Transite Pipe's high delivery capacity means important economies in the operation of municipal water lines.

The ascending curve is a demand curve which shows the increasing flow requirements imposed on a water line due to population growth. The other two curves are capacity curves for two kinds of water lines. One represents a non-tuberculating Transite line; the other represents a water line in which the pipe is subject to tuberculation.

"X" marks the spot where the carrying capacity of the line subject to tuberculation, progressively decreasing due to this costly form of corrosion, just balances the demand. Beyond this point, if pressures and volume are to meet normal consumption and fire-fighting requirements, pumping pressure must be boosted or the main periodically cleaned. It may even be necessary to line the pipe, reinforce it with an additional one . . . or replace it altogether.

Now note the added period of time during which the Transite line continues to meet demands. Here tuberculation is not a factor . . . can never reduce the line's high initial carrying capacity. Thus Transite's freedom from tuberculation means a longer period of efficient economic service to the community—added savings for the taxpayer!

For a description of other savings possible with Transite Pipe, write for Brochure TR-11A. Johns-Manville, Box 290, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville

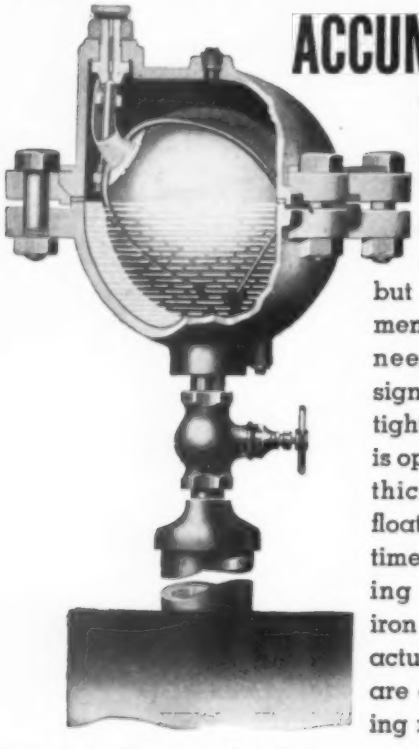
Transite Pressure Pipe

An Asbestos Product

IS *AIR SABOTAGING* YOUR PIPE LINES AND PUMPS?

If not removed, air entrained in a liquid or entering the system through leaky joints and pump suctions, may result in serious damage to the pipe line and to the pumping equipment. These air obstructions not only reduce the operating head, but the area of discharge is considerably reduced or entirely cut off.

SIMPLEX AIR RELEASE VALVES AUTOMATICALLY VENT AIR ACCUMULATIONS



THE Simplex Automatic Air Release Valve is of simple, dependable construction, having but one lever movement which operates a needle valve so designed as to be always tight seating. The valve is operated by a heavy thickness glass ball float, tested to several times the service working pressure. A cast iron shell houses the actuating parts which are of corrosion resisting materials.

Standard Simplex Air Release Valve is for working pressures up to 250 lbs. per square inch. The Type "ARA" valve is similar in design but operates up to 1250 lbs. per square inch. Simplex Air Release Valves are being used extensively on lines and pumps for the release of air in water and sewage lines, oil and gasoline lines, and for industrial process liquids.

Write today for further information on the Simplex Air Release Valve — the automatic watchdog to assure continuous peak flow.

SIMPLEX VALVE & METER COMPANY

6743 Upland Street • Philadelphia, Pennsylvania

MEETINGS SCHEDULED:

(*Continued from page* 106)

Oct. 9—BANGOR, ME.
Maine Water Utilities Association. Sec'y, Earle A. Tarr, Supt. Water District, Winthrop, Me.

Oct. 10-12—COLUMBUS, O. (Hotels Fort Hayes — Chittenden)
Ohio Section A.W.W.A. Sec'y-Treas., F. P. Fischer, 811 Perry Payne Bldg., Cleveland, O.

Oct. 14-17—GALVESTON, TEXAS
Southwest Section A.W.W.A. Sec'y-Treas., Leslie A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

Oct. 16-18—ATLANTIC CITY, N. J. (Hotel Traymore)
Pennsylvania Water Works Association. Sec'y-Treas., E. R. Hannum, 510 Telegraph Bldg., Harrisburg, Pa.

Oct. 16-19—KANSAS CITY, MO.
American Society of Civil Engineers. Sec'y & Exec. Officer, William N. Carey, 33 West 39th St., New York, N. Y.

Oct. 17—BOSTON, MASS. (Hotel Statler)
New England Water Works Association. (Executive Committee Meeting.) Sec'y, W. C. Conroy, 609 Statler Bldg., Boston, Mass.

Oct. 23-25—SAN FRANCISCO, CALIF. (Hotel Whitcomb)
California Section A.W.W.A. Sec'y-Treas., Ray L. Derby, Box 3669 Terminal Annex, Los Angeles 54, Cal.

Oct. 28-30—PITTSBURGH, PA. (Hotel William Penn)
Engineers' Society of Western Penna. (7th Annual Conference.) Chairman, H. M. Olson, Wm. Penn Hotel, Pittsburgh, Pa.

Nov. 7-9—ATLANTIC CITY, N. J. (Hotel Madison)
New Jersey Section A.W.W.A. Sec'y-Treas., C. B. Tygert, Box 178, Newark, N. J.

Nov. 7-9—OMAHA, NEB. (Hotel Fontenell)
Missouri Valley Section A.W.W.A. Sec'y-Treas., M. P. Hatcher, Dir. Water Dept., City Hall, Kansas City, Mo.

Nov. 11-13—RALEIGH, N. C. (Hotel Sir Walter Raleigh)
North Carolina Section A.W.W.A. (Joint Meeting with) **North Carolina Sewage Works Association.** Sec'y-Treas., (both Assns.) Geo. S. Moore, Box 125, Albemarle, N. C.

Nov. 11-15—CLEVELAND, OHIO (Public Auditorium)
American Public Health Association. (74th Annual Meeting.) Exec.-Sec'y, Reginald M. Atwater, 1790 Broadway, New York, N. Y.

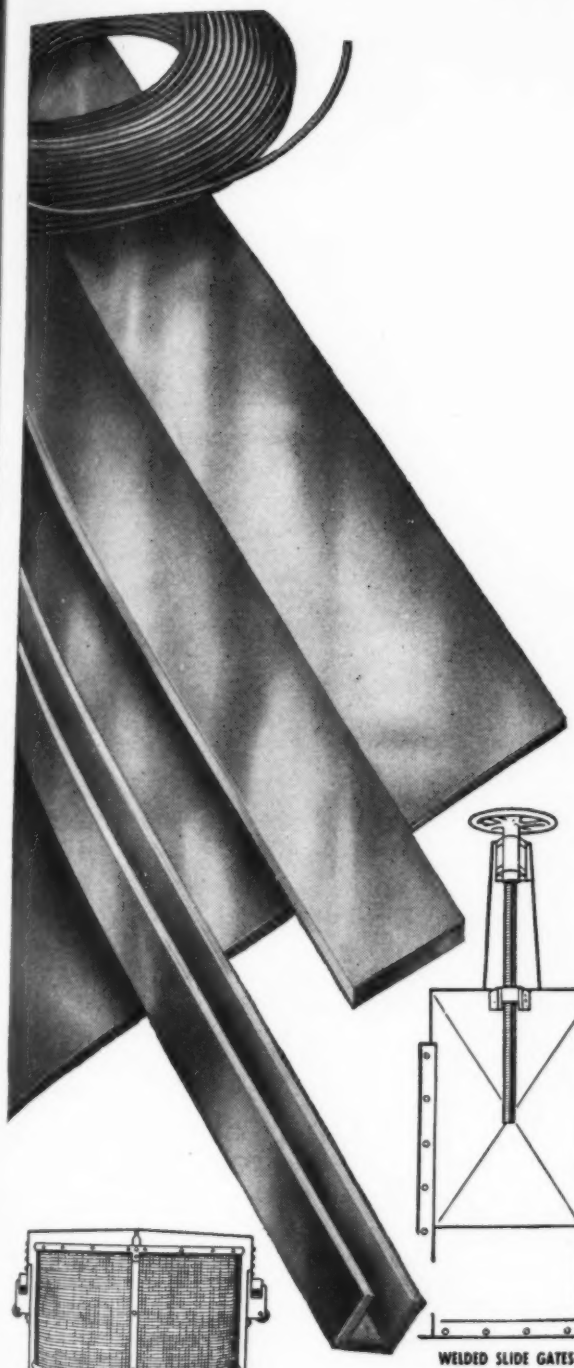
Nov. 14—BOSTON, MASS. (Hotel Statler)
New England Water Works Association. (Sec'y, W. C. Conroy, 609 Statler Bldg., Boston, Mass.

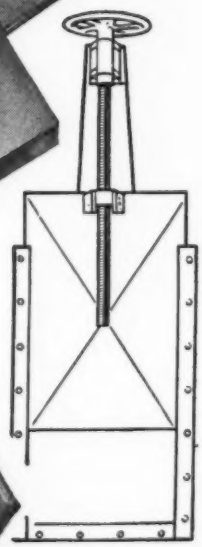
Nov. 14-15—RICHMOND, VA. (Hotel John Marshall)
Virginia Section A.W.W.A. Sec'y-Treas., W. H. Shewbridge, State Dept. of Health, 1506 Greycourt Ave., Richmond, Va.

Nov. 15-17—GREEN BAY, WIS. (Hotel Northland)
Wisconsin Section A.W.W.A. Sec'y-Treas., L. A. Smith, Supt. of Water, City Hall, Madison 5, Wis.

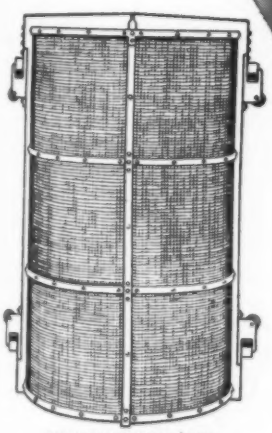
Dec. 11—AUGUSTA, ME.
Maine Water Utilities Association. Sec'y, Earle A. Tarr, Supt. Water District, Winthrop, Me.

Dec. 19—BOSTON, MASS. (Hotel Statler)
New England Water Works Association. Sec'y-Treas., W. C. Conroy, 609 Statler Bldg., Boston, Mass.

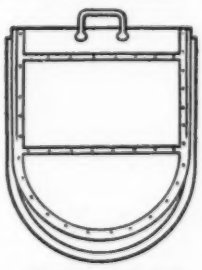




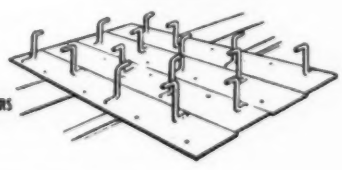
WELDED SLIDE GATES



SCREEN WIRE AND FRAMES



ADJUSTABLE OUTLET WEIR



BEARING PLATES
WITH WELDED ANCHORS

SLOTTED WEIR PLATES

For Strength and Light Weight in Built-up Equipment

Everdur Metal

EVERDUR* Copper-Silicon Alloys are produced in compositions suitable for casting, rolling, drawing, spinning, forging and hot or cold working. Alloys are available that are suited to welded assembly of built-up equipment that is strong and durable, yet light in weight and easy to operate.

Because Everdur Metal combines high strength with the corrosion resistance of copper, it is especially well adapted to the construction of any equipment which requires an extra measure of protection against corrosion.

Proof of the economical long life provided by Everdur may be found in many waterworks and sewage plants throughout the country . . . where 19-year-old installations are still in service. The American Brass Company does not manufacture equipment, but supplies Everdur Alloys in commercial forms to leading fabricators. Write for Publications E-11 and E-6.

46215

*Reg. U. S. Pat. Off.

ANACONDA

Everdur

COPPER-SILICON ALLOYS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

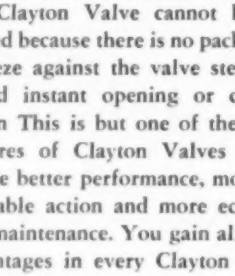
Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

YOU NEVER have to pack a Clayton Valve because there isn't any packing to wear out or start leaking. Since the ordinary valve is usually not repacked until it starts to leak, Clayton Valves eliminate waste due to this cause. Furthermore, the Feather-Touch action of the Clayton Valve cannot be impaired because there is no packing to squeeze against the valve stem and retard instant opening or closing action This is but one of the many features of Clayton Valves which assure better performance, more dependable action and more economical maintenance. You gain all these advantages in every Clayton Valve you install.

THE CLAYTON LINE

includes Remote Control Valves, Float Valves, Altitude Valves, Check Valves, Constant Discharge Pressure Valves, Pump Control Valves, Backflow Prevention Units.



Write for Engineering Data
VALVE DIVISION
CLAYTON MANUFACTURING CO.
Chicago • Alhambra, Calif. • Philadelphia

Here and There with Doc Symons

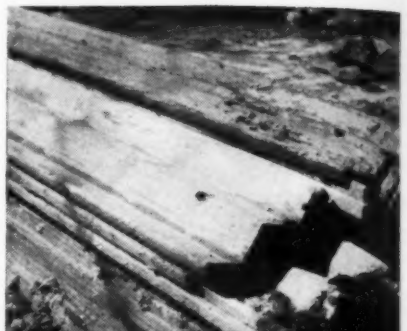
Memories of AWWA in St. Louis: Largest registration yet.—The Auditorium in St. Louis—The crowds in the Refectory (whatever that is) for lunch—Eating hot-dogs at the stand opposite the registration booth—The long (?) trek up the ramp to the exhibit hall each morning and down at eventide—Lloyd Nelson being a stooge for a magician for a change, and having his tie scissored in half for his pains—The 140 or so exhibits bigger and better than ever—Getting lost looking for that Refectory place—Slipping into the darkened opera house to watch the chorus girls (in bathing suits) practice for the forthcoming show—

Sam Newkirk sending everyone to the dictionary to find out that Cephalalgia means a big headache—Listening to Lou Frazza's cogent arguments against the Club Room idea—Having to miss the trip through the world's largest brewery, with several of the boys—Also missing the trip to the water plants (darn it!)—The mayor of St. Louis paying a very charming compliment to the *very* attractive wife of the mayor of St. Louis—The Ratskeller at the Lennox—The Statler Bar—The Coffee Shop in the Jefferson—

Carrying hotdogs and coffee to Lois Jordan, too busy to leave the Secretary's convention office even for ten minutes—Ten trays of scrambled eggs and sausage lined up on the counter of the cafeteria at 3 a.m. after the dinner dance—Wishing Miss (AWWA) Rogers bon voyage on her vacation trip to California—Missing most of the dinner dance on Thursday to work on galley proof for our May issue—The breath-taking beauty on the front cover of the April issue of *Water & Sewage Works* (plug)—The first copies of *Ingenieria Sanitaria*—

Seeing a very pleasing performance of The Student Prince by the

THIS SHEETING PAID OFF AT 100 TO 1



This is how engineers cut costs and speeded the trenching work on an extensive sewer construction program. They specified ARMCO Steel Sheeting and reused it more than 100 times.

The small displacement area of ARMCO Sheeting makes it easy to drive — easy to pull. Corrugated design assures ample strength yet keeps weight down to facilitate handling and speed installation. In driving, sections butt together or are held securely in place by continuous interlocking joints that assure correct alignment and practical water-tightness.

You'll find other economies in ARMCO Sheeting too. It is low in first cost because you buy only the exact weight you need. And since the sheeting is nestable it requires comparatively little space for shipment and storage.

Write us for prices and detailed information. Armco Drainage & Metal Products, Inc., and Associated Companies, 2965 Curtis St., Middletown, O.

ARMCO

ARMCO STEEL SHEETING

Civic Opera company and hearing Si Carmen talk about the wizard Steinmetz between the acts—The printers' strike which delayed ENR's lists of registrants—The new residual chlorine titrator—The man from the Southwest Section who accidentally locked his better half out of their room and proceeded to sleep through till noon next day—A quiet evening with the Lindy Harpers, the Casey Jones, the Larry Lingnors, Bill Weir, Jack Van Atta, Jeff Corydon, Johnny Horgan, Lee McMahon, after the family hour entertainment on Monday—Another pleasant evening with Jo and Mary Quinn of Terre Haute—

The slide which caught fire when Mr. Fisher was explaining the M-Scope during his paper (it was No. 13, in case you're superstitious—Too many sessions that ran too long over time—But an audience that stuck almost to a man, long after lunch time, just to hear Abel Wolman talk (worth it, too)—

Meeting Jack Service, the man who writes the house organ for R. W. Sparling and finding that he reads my stuff, too—Having a so-so steak at some place in South St. Louis and having to wait for half an hour for a cab back to the city—Taxicab rides to and from the hotels to the auditorium—Delicious (du kanst noch einmal sagen) steaks at "The Stymie" with still other friends I see too seldom—Lindy Harper's Lie Detector—Carl Brown, the impressario from Chicago—The Jim Brown's and Seaver Jones et al. not getting one of those wonderful steaks at the Stymie after a long taxi ride (we warned you to make a reservation)—

The alarm bell on the Omega machine keeping the fellows in the next booth awake, eh, Jack—Having to miss the highlight of the meeting, Lou Howson's paper on water rates—Chatting with Col. Rockwell about the vagaries of words that have more different meanings in different parts of the country and between here and Britain—

The ride back to New York on the Penn Special—With Conductor Sigworth—And a car of strawberries on the front end—And bridge games all over the place—Mike Glace rushing to the diner before the train left St. Louis, so he wouldn't miss a single minute of bridge—Marsden Smith collecting pennies from everyone to get enough money to go to the San Francisco Convention next year—That engineering editor on another mag whose lovely wife found him practically useless as a husband on the trip back because he, too, had a fist full of cards—The Brush's having to wait a long time for lunch

50 YEARS

Extra heavy bodies cast from specification red brass, perfect taper and water-tight bearing, along with special formula valve grease, characterize each individually inspected and tested Glauber ground-key stop.

K-1034—Inverted Key Curb Stop Illustrated. Loose tee handle, round way, inside iron pipe threads. Also available in Minneapolis, Indiana and Kansas City code. Descriptions of other patterns, types and fittings upon request.

The quality, workmanship and standard of excellence built into "Red Brass" Glauber ground-key curb and corporation stops for the past 57 years are serving many communities across the nation. Today, with improved foundry and precision production methods, you are further assured that they are now unparalleled for long life service and smooth, easy operation. Write today for quotations on your specific waterworks requirements.

THE Glauber BRASS MFG. CO., KINSMAN, OHIO

Subsidiary of H. B. SALTER MFG. CO., *Marysville, Ohio*

Glauber

because the diner was still serving breakfast to the late arisers as we passed the Altoona water reservoir —Chatting with Griff, Alan Darby, Joe Gilbert, Jim Harding and many others and sharing Reeves Newsome's cab from Penn Station to Grand Central—Home.

* * *

No! Sam II, that column "Here and There" in some other magazine is not written by yours truly.

* * *

Strictly Local: A newcomer among news letters appeared this Spring. Titled *WATER WORKS NEWS of New York State,* it is strictly local for—you guessed it—the boys of N. Y. State. Charlie Cox edits the *WATER WORKS NEWS,* which will be a quarterly and will feature unusual problems of smaller plants, gadgets, current news, and questions and answers. Charlie's news letter joins distinguished company, such as *The Spillway* (Ill.), *Out of the Faucet* (N. Car.), and *The Waterspout* (Ind.), among others.

* * *

I suppose you have noticed that in the magazine section we are running a series of articles on Mathematics by my old side kick of Western New York, Dr. Warren Eglof, Niagara University. If I may have a minute of your time I'd like to make a couple of comments in connection with that series.—Too frequently, water or sewage operators, managers, engineers and chemists collect, calculate and record data that are misleading if not inaccurate. Too often, also, data are not properly recorded and therefore do not make possible the fullest use of the data, with the result that important relationships are either obscure or remain to be calculated.

The improper use of fractions, decimals, percentages, or rates often mars an otherwise useful report. Lack of knowledge of significant figures and weighted averages may lead to reliance in false accuracy or the assumption that plant operating efficiencies are better, or worse, than they actually are.

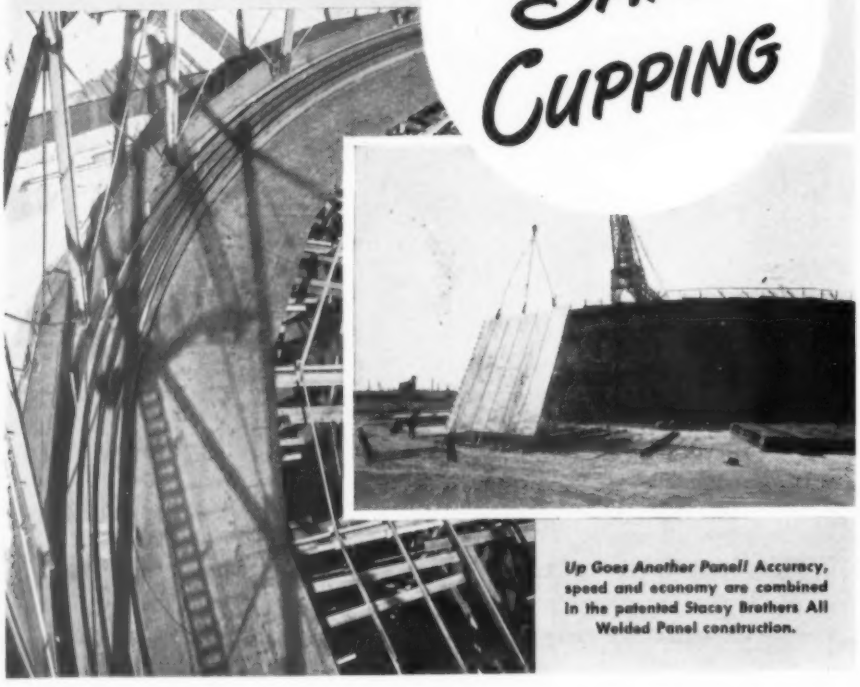
The operation of water and sewage works requires no advanced mathematical operations but the proper use of elementary mathematics will greatly improve the value of laboratory and operating data. That's why we asked Dr. Eglof to write this series, a study of elementary mathematics. Simple and straightforward though the presentation may be, these articles should not be read too hurriedly, for Dr. Eglof has wasted no words, no matter how simple it sounds. I've a hunch that regardless of your training, experience, or education, you'll learn something from this series. Both Warren and I hope so.

* * *

Faces I missed at St. Louis: Ralph B. Carter, Jr., who was, I understand, hospitalized in Philadelphia at the time—Harry, the Water Fixer, Krum of Allentown—Jess Giesey, my old boss at Evansville, Ind., and later colleague at Buffalo, and now Water Supt. at Toledo, O., who sent his right hand bower, Al Kruger, his Chief Chemist—Alan Drake, now out of the water business —Roswell Roper—George Norcom—and besides too many others, Throckmorton P. (The Great) Gildersleeve, the Water Commissioner of Summerfield.

PRECISION FABRICATION AND CONTROLLED WELDING ASSURES

SAFE CUPPING



Up Goes Another Panel! Accuracy, speed and economy are combined in the patented Stacey Brothers All Welded Panel construction.

That's the kind of workmanship you get with Stacey Brothers All-Welded Panel construction!

This wet seal holder, one of our most recent installations—at Long Beach, California—has a capacity of 5,000,000 cubic feet. Five lifts bring it to a height of 211 feet—yet each lift nests *true* in a space less than one-half of one per cent of the 100 ft. radius. That's close tolerance!

The secret lies in the cup and grip assembly—*all-welded prefabrication*—an important and exclusive Stacey Brothers feature.

But safe cupping and freedom from binding is not the only advantage. You'll get longer holder life, quicker installation, lighter weight, lower material costs—and freedom from unsightly bulges. For full details write for Bulletin W-45.

THE STACEY BROTHERS GAS CONSTRUCTION CO.

One of the Dresser Industries

5535 VINE ST. • CINCINNATI 16, OHIO

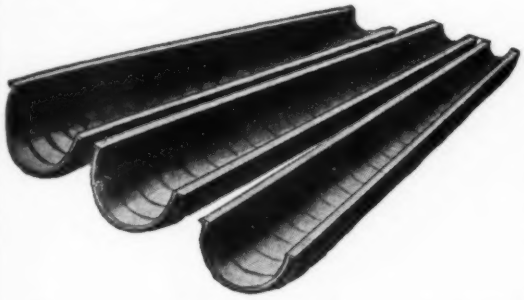
Stacey Brothers TANKS

GOVERNMENT-OWNED SURPLUS

GALVANIZED CULVERT PIPE . . .

now AVAILABLE

CORRUGATED . . IN HALF SECTIONS . . NESTED . . FLANGED TYPE FOR BOLTING



12"	.42 per ft.	36"	1.53 per ft.
18"	.45 per ft.	48"	2.04 per ft.
24"	.75 per ft.	60"	2.93 per ft.
30"	.93 per ft.	72"	3.59 per ft.

VETERANS OF WORLD WAR II: This surplus property is offered to priority claimants including Veterans of World War II. To help you in purchasing surplus property, a Veterans' Unit has been established in each of our Regional Offices.

Here is real opportunity to get a quantity of high quality culvert pipe without delay—for surface water disposal. Each section of pipe is fabricated in half sections, flanged and nested for ease of handling and shipping. When in use, the top half is fitted to the bottom half and bolted tight. All sizes from 12 inches to 72 inches in diameter. Over a million and a half dollars worth of this surplus piping is available and stored at War Assets Administration Regional Offices throughout the country. Check the price and size listing at left, then phone your order to your nearest War Assets Administration Regional Office listed below . . . or if you wish, clip the coupon—indicate sizes and quantity wanted—and *mail right now.*

This surplus property subject to prior sale.

ORDER FORM

To War Assets Administration:

.....

.....

.....

Name.....Tel. No.....

Firm.....

Address.....

City.....State.....

MAIL TODAY

516

WAR ASSETS ADMINISTRATION

OFFICES LISTED BELOW ARE TEMPORARILY IN RECONSTRUCTION FINANCE CORPORATION AGENCIES

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cleveland • Dallas • Denver Detroit • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville Minneapolis • Nashville • New Orleans • New York • Oklahoma City • Omaha • Philadelphia Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane Cincinnati • Fort Worth (Telephone 3-5381)

Stu Coburn is one of those fellows who like to see a lot of short items in this column and not so many of these long ones. Try me again next month, Stu—and where are those contributions *you* promised to send me?

* * *

Charlie Murray writes that up in Oshkosh (B'Gosh), Wis., they are go-getters when it comes to collecting garbage, and he enclosed a bid advertisement to prove it, to wit: "New Bid, Garbage Getters, Oshkosh, Wis."

* * *

It was said in fun, but when Sherm Chase read a paper on postwar planning last year, someone behind me said, "Next thing we know, 'Sherm' will be running for Congress." - - - Massachusetts could do worse, brother.

* * *

What do you know—no golf scores yet in this year's competition for the Here and There Cup.

GRINNELL SOCKET FITTINGS

Save up to 26% in weight!

	Grinnell		Competition	
	Weight	Run from bell to bell	Weight	Run from bell to bell
4"	96 lbs.	11 in.	128 lbs.	22 in.
6"	147 lbs.	13½ in.	200 lbs.	24 in.
8"	222 lbs.	16 in.	294 lbs.	26 in.
10"	325 lbs.	19 in.	395 lbs.	28 in.
12"	417 lbs.	21½ in.	512 lbs.	30 in.

Grinnell Socket Fittings have the same socket and spigot dimensions and wall thickness as AWWA standard class D pipe. More compact design makes them easier to handle than competitive fittings. They fit neatly into close quarters and speed installation. Friction loss is not increased. Approved by Underwriters' Laboratories.

Bends are provided with lugs to take socket clamps. Special coating of coal-tar pitch varnish.

Write for catalog, "Water Works Specialties".

GRINNELL COMPANY INC.

EXECUTIVE OFFICES: PROVIDENCE 1, R. I.

Branch Warehouses

Atlanta 2, Ga.
Charlotte 1, N. C.
Chicago 9, Ill.
Cleveland 14, O.
Houston 1, Tex.
Los Angeles 13, Cal.
Minneapolis 15, Minn.
New York 17, N. Y.
Oakland 7, Cal.
Philadelphia 34, Pa.
Providence 1, R. I.
St. Louis 10, Mo.
St. Paul, Minn.
San Francisco 7, Cal.
Seattle 1, Wash.

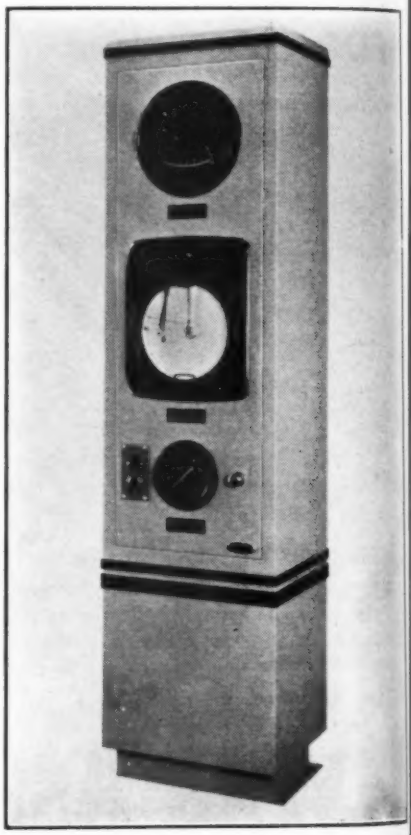
GRINNELL

WHENEVER PIPING IS INVOLVED

MANUFACTURERS' and EQUIPMENT NEWS

Pumping Control Unit

The accompanying photograph shows the new Foxboro Control Cabinet for Water Pumping Stations. This unit developed since the war was first exhibited at the St. Louis meeting of AWWA. The cabinet is ready to be installed with the instruments ready to be connected. The top instrument is an Indicating Rotax Altitude Controller, set to start the pump at 80 ft. and to shut it off at 100 ft. This unit allows for close control of the head maintained in an elevated tank. Different heads can be established.



The next instrument below is a Master Meter with an extra pen for recording, in feet of water, the elevation controlled and indicated in the top unit. This is the regular Foxboro Master Meter Type 3 Flow Re-

DESCRIPTION

%Proportioneers% Duplex Chem-O-Feeder is a constant rate of feed duplex diaphragm pump with two reagent heads for feeding one or two liquids. The unit is provided with standard "See-Thru" plastic reagent heads and the feed of each pump is manually adjustable while pump is operating by means of stroke length adjustment knob. The mechanism is enclosed in an oil bath and the stroking arrangement is designed for feeding an almost constant stream. This unit is provided with ⅛ HP or ¼ HP motor for feeding against positive pressures of up to 100 lbs. per square inch.

CHEMICALS HANDLED

Calcium and sodium hypochlorite — aqua ammonia — aluminum sulphate — sodium carbonate — lime slurry — caustic — carbon slurry — ferric chloride — ferric sulphate, etc.

SPECIFICATIONS
(per pump head)

Stroke length . . . . . 0 to 0.25"
Delivery per stroke . . 0 to 9.5 cc (at 10 lbs.)
0 to 8.3 cc (at 100 lbs.)
Stroking rate . . 17, 32, 57 strokes per minute
Maximum capacity . . . 8.6 GPH (at 10 lbs.)
7.5 GPH (at 100 lbs.)
Maximum operating pressure —
125 lbs. per sq. inch. for intermittent duty
100 lbs. per sq. inch. for continuous duty
Maximum chlorine feed per 24 hours using 12½% sodium hypochlorite solution . 200 lbs.

TYPICAL USERS

Water Plants (municipal and private) • Swim Pools (municipal and private) • Bottling Plants, Bleacheries • Oil Producers (secondary recovery) etc.

SHIPPING INFORMATION

Net weight . . . . . 110 lbs.
Gross weight . . . . . 140 lbs.
Box size . . . . . 20" x 14" x 18"

%PROPORTIONEERS, INC.%

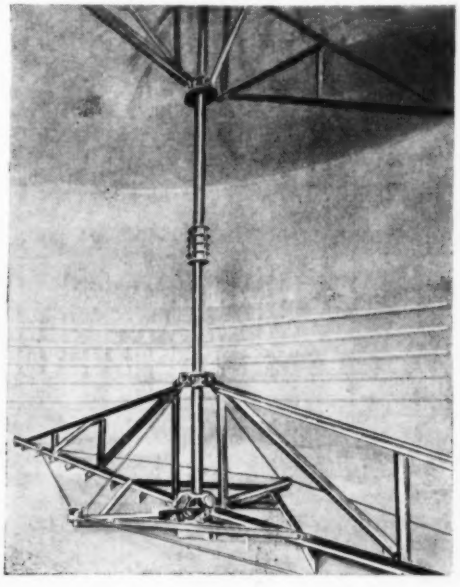
9N CODDING STREET, PROVIDENCE 1, RHODE ISLAND

DIGESTERS

CARTER

"Ruggedly constructed . . . designed and developed to meet the maximum demands of the toughest job in sewage treatment . . . a unit of tremendous strength with proven ability under continuous heavy load duty" . . . that's the CARTER mechanism for fixed roof sludge digestion tanks.

*write for Bulletin No. 4311



★ View at left shows interior of digestion tanks at the town of Tonowanda, N. Y., utilizing CARTER—45' diameter mechanisms.

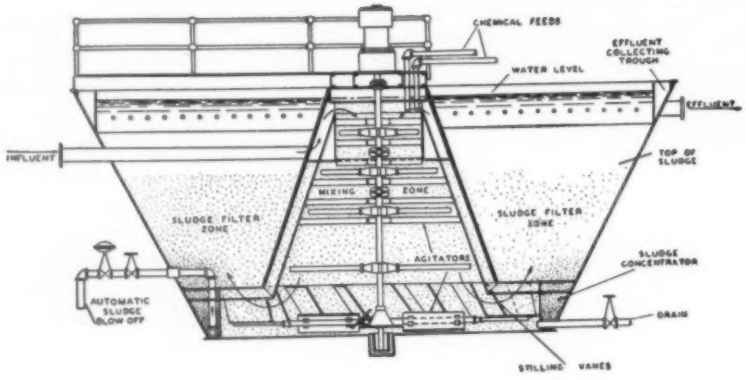
We've placed the emphasis on TOUGH for this digester mechanism. Nowhere in the field will you find a unit for this service that measures up to CARTER standards. From drive mechanism to sludge sump scrapers, we designed to give you the best. Our literature describes in detail the structural features . . . Write for it today.

RALPH B. CARTER CO.

HACKENSACK—NEW JERSEY

New York Office: 53 Park Pl., New York 7, N. Y.

A new, more efficient means for removing impurities from municipal water supplies



PERMUTIT *(SPAULDING)* PRECIPITATOR

IN the Spaulding Precipitator, Permutit* has combined precipitation and separation in a single treatment step, so that water being treated flows clear from the top of the equipment.

The Vertical Precipitator, as shown schematically above, was the first development of this "sludge blanket" principle, which provides a sharp demarcation between sludge and clear effluent. Other designs are available.

Permutit Precipitators not only represent a more efficient means of cold lime treatment, but are more compact than older style methods. Permutit will be glad to cooperate with you and your consultants on any problem of producing a clear, soft, iron-free water. Many types of equipment are available, and more than 30 years' experience is at your service.

For full particulars write to The Permutit Company, Dept. W6, 330 West 42nd Street, New York 18, N. Y., or Permutit Co. of Canada, Ltd., Montreal.

*Trademark Reg. U. S. Pat. Off.

PERMUTIT

WATER CONDITIONING HEADQUARTERS

for CONCRETE and STEEL!

Inertol Protection Means Lowest Cost Per Year

INERTOL COMPANY, INC. NEWARK 5, NEW JERSEY and SAN FRANCISCO 7, CALIFORNIA

corder and can be furnished for different pumping conditions.

The bottom instrument is a Draw-Down Indicator, which shows the difference in elevation of water level in the well casing under static conditions and under pumping conditions. If desired this indicating instrument can be changed to a recorder. A "manual-off-automatic" switch as well as circuit breaker and other auxiliary electrical equipment is furnished with the unit. A time-delay relay may be used where surge conditions require it.

This unit, which is easy to install, will add to the beauty of a water pumping plant as well as to aid its proper functioning. Further information on this unit may be obtained from the Foxboro Co., Foxboro, Mass.

A C F Extends Lubricated Plug Valve Line

American Car and Foundry Co. has announced that starting in June they will extend their production of ACF Lubricated Plug Valves to include cast steel valves in series 100 and 300 in sizes ½ in. to 8 in. These cast steel ACF Lubricated Plug Valves will be particularly adapted for high pressures and temperatures where required and in addition the cast steel necessarily offers greater abrasion resistance and, on some services, greater corrosion resistance.

The new applications for these cast steel valves include any service where cast steel valves are indicated as contrasted with a semi-steel, cast iron, or bronze valve.

Redi-Heat Block

Mine Safety Appliances Company has developed a new safe, fast heating system for first aid use. This M.S.A. Redi-Heat Block employs a sealed chemical charge, which may be replaced more easily than a flashlight battery. No liquids are used and a simple spring activating lever in the block starts the operation which produces heat throughout the block within one minute's time. The heat production is within a small metal cylinder containing a newly developed chemical compound.

Operation of the M.S.A. Redi-Heat Block is simple and completely safe. An insertion of a fresh Redi-Heat

"For Washing Purposes Only"

Remember when the common water supply was often good only for external use and never to be taken internally. When each family had to treat its own water to make sure it was fit to drink.

What a difference today when every sizable community has pure, palatable water safe for drinking as well as for washing. Most communities can boast of a well trained and vigilant staff of water works officials who are mindful that upon them depends the health of their neighbors.

Yes—the faithfulness of you in whose care the water supply is placed has enabled the United States to practically eliminate disease from water borne bacteria. Hooker is proud to have had a part in this remarkable record. One of the earliest producers of Chlorine, the Hooker Electrochemical Company has endeavored to serve water works officials well. This has been done by continuing to supply uniform high quality Chlorine and other chemicals necessary to the maintenance of a safe water supply. To be sure of maintaining your unbroken record of safety in water supply, continue to specify Hooker Chemicals.

HOOKER ELECTROCHEMICAL COMPANY

Buffalo Ave. and Ward St.
Niagara Falls, New York

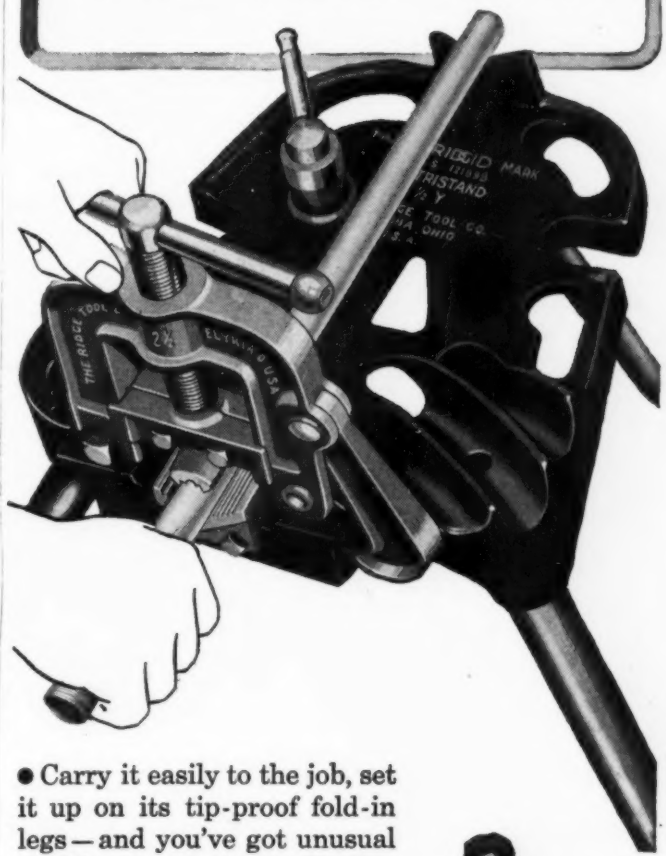
New York, N. Y.
Wilmington, Calif.
Tacoma, Wash.

HOOKER CHEMICALS

Ferric Chloride Caustic Soda
Chlorine Muriatic Acid 8516

RIDGID TRISTAND

gives you a smart vise and handy work-bench all in one...

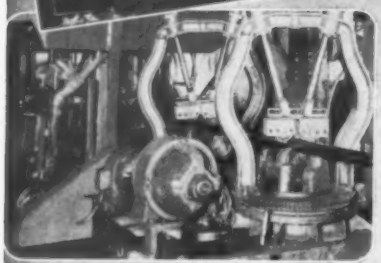


● Carry it easily to the job, set it up on its tip-proof fold-in legs—and you've got unusual working convenience. Roomy tray for dope pot, oil can, handy slots for tools, a pipe rest to make cutting or threading easier, 3 benders that won't dent pipe—and either yoke or chain vise with LonGrip jaws that hold pipe firmly without scratching. More for your money; ask your Supply House for RIDGID Tristands.

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U. S. A.

Sound Factory methods assure long service life to

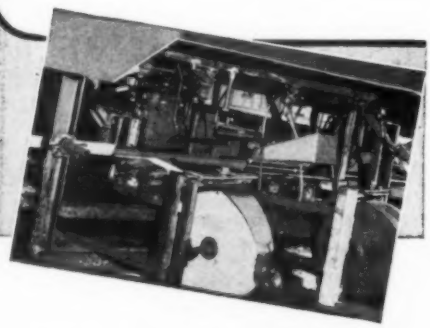
HILL HUBBELL PIPE PROTECTION



4 progressive steps in FACTORY applied Steel Pipe Processing are illustrated in the accompanying factory scenes.

The pipe is conveyed, cleaned — primed — coated — wrapped and loaded all indoors, by modern mechanical methods; each operation under absolute control.

HILL, HUBBELL Steel Pipe Protection keeps your pipe lines always working.



MACHINE CLEANED PRIMED COATED AND WRAPPED STEEL PIPE

GENERAL PAINT CORPORATION
HILL, HUBBELL & CO. · Division · Cleveland, Ohio
· EXPORT OFFICE: SAN FRANCISCO, CALIFORNIA, U. S. A. ·

FRED STUART and AL BRUMLEY
GOT OUT THE DICTIONARY

and leafed through it like mad! When they came to the word "Activated" they stopped . . . and combined the word with "Alum"!
YOU KNOW THE REST!
A revolutionary Activated Alum . . . which forms a floc that's quicker and tougher than a Dead End kid . . . which cuts down your number of filter runs . . . which improves taste and odor by an immeasurable per cent!
SO . . . ORDER NOW FROM

STUART-BRUMLEY CORP.
516 N. CHARLES ST. BALTIMORE, MD.

charge will give continued heat application and it may be done very simply. The charges have unlimited storage life and are always ready for instant use. These Redi-Heat Blocks may be obtained from the Mine Safety Appliances Co., Pittsburgh 8, Pa.

T. E. Mueller New President of American-Standard

H. M. Reed, Sr., Remains Chairman of the Board, H. M. Reed, Jr., New Vice-Pres.

American Radiator & Standard Sanitary Corp. has announced the election of Theodore E. Mueller of Pittsburgh as President of the corporation. Mr. Mueller was formerly

T. E. Mueller

Henry M. Reed, Jr.

vice-president and general manager of manufacturing, and in his new position will succeed Henry M. Reed, who has been both president and chairman of the board since 1938. Mr. Reed, Sr., will continue as board chairman.

At the same time, Henry M. Reed, Jr., was elected Vice-President and General Manager of Manufacturing, to succeed Mr. Mueller in that position. Mr. Reed, Jr., has formerly been a manager of the Louisville Works of the corporation. Hereafter he will be located in the general offices in Pittsburgh.

Kay-Tite For Waterproofing Building Materials

The Kay-Tite Co. of West Orange, New Jersey, is furnishing a guaranteed waterproofing product for treating such things as cinder block, unglazed tile, or rough concrete. Kay-Tite is painted on after first making the walls soaking wet. After drying, the material has the appearance of an attractive painted surface.

Further information on this masonry waterproofing may be obtained from Kay-Tite Co., West Orange, N. J.

RUST & BITUMINOUS ENAMEL CORROSION

There is only one means of permanent protection against the inroads of oxidation — that's *Bituminous Enamel*

We are nationally known approved Applicators of Bituminous Coatings for treating Steel Standpipes, Elevated Water Tanks, Water Mains, Penstocks, Lockgates and other Water Works installations.

IN CASES REQUIRING CATHODIC PROTECTION, WE RECOMMEND BITUMINOUS COATINGS TO ELIMINATE CORROSION AT WATER LEVELS AND ABOVE.

SEND FOR FREE BOOKLET

W. A. BRIGGS BITUMEN Co.
3303 Richmond Street,
PHILA. 34, PA.

EXPERIENCE + SKILL + PRIDE OF PRODUCT
= PUMPS *"by Aurora"*
AURORA CENTRIFUGAL • APCO TURBINE-TYPE

The able performance of our pumps, with high efficiency and lasting dependability, fulfills the fundamental purpose of our business. Put a PUMP "by Aurora" on that next liquids handling job. You'll LIKE IT, TOO!

Aurora Deep Well Turbines for all conditions—4" to 24"

Type AD Hor. Split Case, Two Stage Centrifugal

NSA Aurora Centrifugal Sump Pump

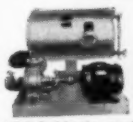
Type OD Hor. Split-Case Double Suction Single Stage Centrifugal

Type G M C Close-Coupled Centrifugal

Apco Turbine-Type Pumps The simplest of all pumps. Ideal for small capacity, high head duties. Silent, compact and lasting.

The ONLY MOVING PART IN the APCO

Type GGU Side Suction Single Stage Centrifugal



APCO Horizontal Condensation Return Unit

APCO Single Stage Turbine-Type

Write for CONDENSED CATALOG M or See Our Catalog in SWEETS.

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA Always PUMPS

AURORA PUMP COMPANY

68 Loucks Street, AURORA, ILLINOIS

INSTALLATIONS WORLD WIDE

LARGEST CITY TO SMALLEST VILLAGE

VALVES COMPLETE EQUIPMENT FOR WATER WORKS FILTRATION AND SEWAGE DISPOSAL PLANTS LATEST "COREY TYPE" **HYDRANTS**

Write for Catalogue and Information

IOWA VALVE CO.

General Offices:
Hubbell Bldg., Des Moines, Iowa

Plant:
Oskaloosa, Iowa

FOR BETTER

pH Control and WATER TESTS

there is nothing like

NON-FADING GLASS COLOR STANDARDS

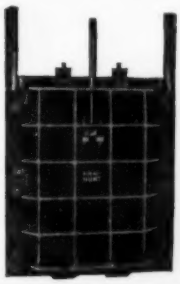
Pocket Comparator No. 605

Permanent reliability of Hellige Glass Color Standards, accuracy of color comparison, simplicity of the technique, and compactness of the apparatus are exclusive features of Hellige Comparators not found in any similar outfits.

WRITE FOR BULLETIN No. 602

HELLIGE
INCORPORATED
3718 NORTHERN BLVD. LONG ISLAND CITY 1, N.Y.
HEADQUARTERS FOR COLORIMETRIC APPARATUS

RODNEY HUNT



GATES and HOISTS

Metal or timber sluice gates of all sizes and designs, approved by engineers everywhere. Improved gate stands and hoists for hand or motor operation. Also flap and mud valves, shear and filler gates, trash racks and rakes. Dependable canal equipment from dam to tail-race since 1840.

Write for Special Catalog Today!

RODNEY HUNT

RODNEY HUNT MACHINE CO.
118 Lake St., Orange, Mass., U. S. A.

A MATHEWS HYDRANT IS NO SPHINX

A Mathews Hydrant can be turned to face any direction in the compass. This is due to the unique swivel flange at the base of the nozzle section. You simply loosen a few bolts . . . and turn the head with the minimum of labor and expense. And for the same reason, the number and size of the nozzle outlets can be changed by simply changing the head . . . without shutting the water off.

Take a look at the working parts—they are all contained in a removable barrel. In case something goes wrong, you unscrew the barrel from the elbow, lift it out, insert a spare. No digging or excavating; the pavement is intact; life and property are protected with almost no interruption at all; repair costs are held down. Mathews design is noteworthy throughout—oiling from the exterior; operating threads kept free of rust and dirt; frost-proof mechanism; protection case "Sand-Spun" for greater strength, elasticity, freedom from stresses. These and other features explain why there are so many Mathews hydrants in use everywhere in the world.

MATHEWS HYDRANTS
Made by R. D. WOOD Company
PUBLIC LEDGER BUILDING
INDEPENDENCE SQUARE, PHILADELPHIA 5, PA.

MANUFACTURERS OF SAND SPUN PIPE (CENTRIFUGALLY CAST IN SAND MOLDS) AND R. D. WOOD GATE VALVES

John P. Stenner to Represent A. P. Smith

Mr. John P. Stenner has joined the sales organization of The A. P. Smith Manufacturing Co. and will represent the company in the States of Virginia, West Virginia, Delaware, part of Maryland, and the District of Columbia. The district sales

John P. Stenner

office will be located at 412 North St., Portsmouth, Virginia. Mr. Stenner has been associated with the water works profession for some 20 odd years, is familiar with water works equipment, and is well known by water works engineers and municipal officials.

Builders-Providence Makes Second Service Award

Builders Iron Foundry (Builders-Providence, Inc.) of Providence, R. I., held its second service award dinner recently in Providence, R. I. Fifty-four employees who have completed more than 25 years of service

welcomed the recipients of new awards. Two new awards were made for forty years' service, five for over twenty-five years', twenty for over ten years', and fifty-seven for over five years' service. The accompanying photograph shows Henry S. Chafee, President of Builders Iron Foundry, presenting a forty years' Service Award to Antonio Rossi, a molder. The very pretty lady is Mrs. Charles S. Richardson, whose "hubby" is on the extreme right.

ANTHRAFILT
A Filter Medium For All Purposes

ANTHRACITE EQUIPMENT CORP.
101 Park Ave. New York

All correspondence regarding sales and engineering should be addressed to:

PALMER FILTER EQUIPMENT CO.
822 E. 8th St. Erie, Pa.
Engineers and Sales Agents

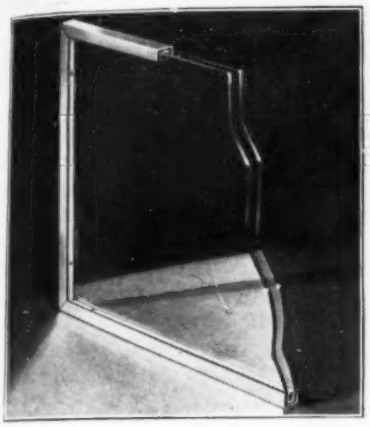
THE Phipps & Bird LABORATORY MIXER . . .

IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.
PHIPPS & BIRD, INC. Richmond, Va.

New Type Double-Glazed Window ("Twindows")

Pittsburgh Plate Glass Co. have announced the development of a new type, efficient double-glazed window insulating unit known as "Twindow" for industrial, home, business and commercial uses.

These Twindows are integral insulating units of two or more plates of glass between which is a quarter-inch or half-inch hermetically sealed air space. The unit uses hollow aluminum tubing to separate and hold the glass plates in position, and is framed with a light gauge stainless steel channel.



Use of these Twindows will eliminate frosting or condensation in homes, offices or laboratories. It also improves air conditioning and heating because it cuts down heat loss through the window, thereby allowing larger window spaces. These Twindows may be obtained with clear polished plate glass, or special units can be had using heat absorbing glass or transparent plastics. Any size or combination may be obtained and it is even possible to obtain certain simple cylindrical bends.

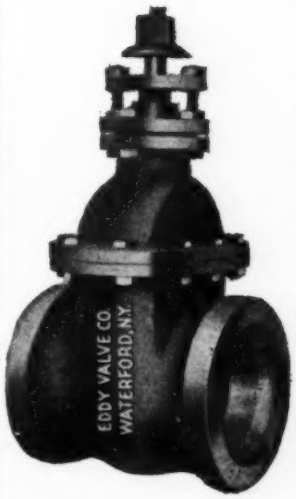
Further information on the new "Twindow" units may be had on request to Dept. PRT, Pittsburgh Plate Glass Co., 632 Duquesne Way, Pittsburgh 22, Pa.

S. Morgan Smith Opens San Francisco Office.

The S. Morgan Smith Co. of York, Pa., has announced the appointment of Ross L. Mahon to have charge of a new office for the company, located at 1 Montgomery Street, San Francisco 4, Calif.

The new office will serve as an outlet for all of the equipment manufactured by the S. Morgan Smith Co.

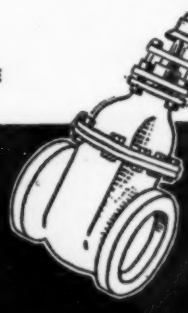
HOW LONG WILL IT BE UNTIL HE GETS YOUR VALVES OR HYDRANTS?



FATHER TIME has a way of raising the devil with some valves or hydrants, and being kind to others. Hundreds of water works men can attest to the fact that time has been kind to Eddy Valves and Hydrants.

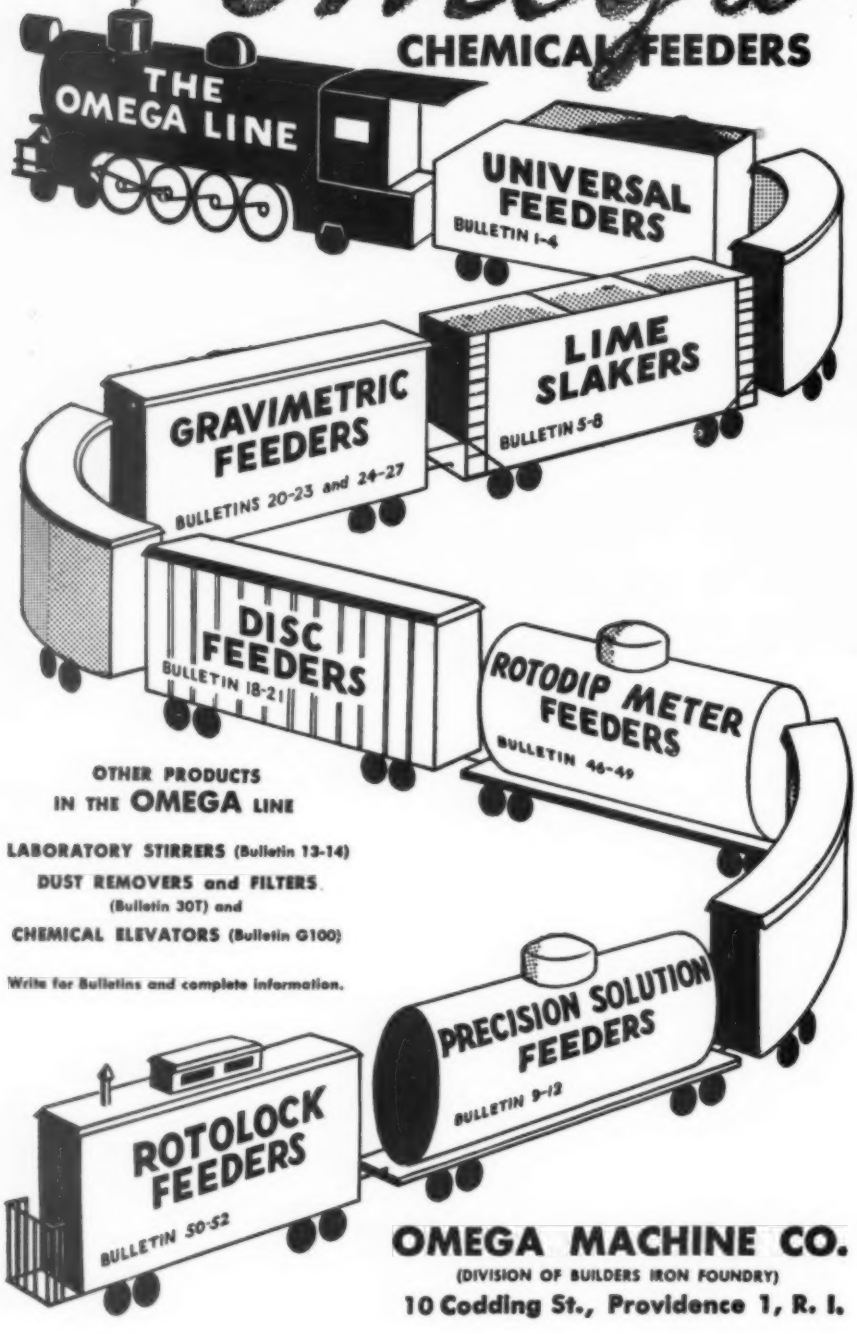
There's a reason — and that reason is sound design and skillful workmanship. You can put an Eddy valve or hydrant down — and leave it down, without any fear of trouble. Specify Eddy when you buy.

EDDY FOR LONGER SERVICE



EDDY
VALVE COMPANY
WATERFORD, NEW YORK

omega
CHEMICAL FEEDERS



OTHER PRODUCTS IN THE **OMEGA** LINE

LABORATORY STIRRERS (Bulletin 13-14)
DUST REMOVERS and FILTERS (Bulletin 30T) and
CHEMICAL ELEVATORS (Bulletin G100)

Write for Bulletins and complete information.

OMEGA MACHINE CO.
(DIVISION OF BUILDERS IRON FOUNDRY)
10 Codding St., Providence 1, R. I.

REPAIR and SAVE
Water Meter Measuring Chambers
with the
MEMPHIS SLOT INSERT
of stainless steel with new bronze thrust roller.
For further information and *free* 5/8" samples
address
METER SPECIALTY CO.
1332 N. Seventh St. Memphis, Tenn.

EDSON
DIAPHRAGM PUMPS
Hand Sizes 2", 2½", 3", 4"
Power Sizes 3" and 4"
Open Discharge or Force Pump
Edson Special Suction Hose
Red Seal Diaphragms
Strainers and Foot Valves
Hose Spanners—Adapters
THE EDSON CORPORATION
Main Office and Works: 49 D St. South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn

Former Permutit Executives Organize New Company

Three former executives of The Permutit Co., S. B. Applebaum, Vice-President and Director, H. L. Tiger, Vice-President and Director, and Norman E. Brice, Mechanical Engineer, announced their resignations

N. E. Brice S. B. Applebaum H.L. Tiger

on April 15, 1946, after about thirty years of association with that firm. Mr. Applebaum had for some time been in charge of technical policy, contract and guarantee approval, mechanical design and developments. Mr. Tiger had been in charge of research and development, and patents. Mr. Brice had been in charge of engineering layout and design, and factory construction and maintenance.

Messrs. Applebaum, Brice and Tiger are organizing a new company under the name of Liquid Conditioning Corporation which will carry on a general business in the field of water conditioning for industrial, municipal, railroad and household use. Also, they will provide equipment and materials for conditioning other liquids than water.

The new company has established offices at 423 West 126th St., New York City, and a plant is to be constructed in Linden, N. J., which is very close to New York.

Chicago Bridge Wins Advertising Award

The Chicago Bridge & Iron Co., Chicago, was awarded a certificate in Division Five of the Fourth Annual Business Paper Advertising Competition sponsored by The Associated Business Papers. The advertisement which won the award appeared in May 1945 and showed a water tower at Birmingham, Michigan, where improved uniform, continuous flow resulted from the erection of the elevated tank.

Ace Portable Blower

A portable hand blower, 1 H.P., 2 speeds, is offered by the Ace Company of Ocala, Florida, as a means of removing dust and grit from motors and machinery. Not only is this device useful for this purpose, but it may also be used to spray paint, lacquer, or insecticide. With a set of attachments the Ace may be used as a vacuum cleaner. Further information may be obtained from the Ace Co., 36 N. Orange St., Ocala, Fla.

Permutit Names New Technical Manager

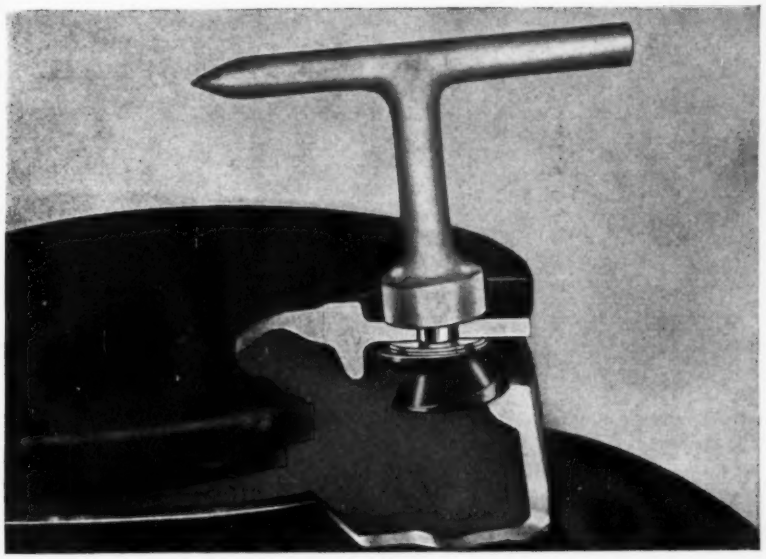
H. L. Bechner has been appointed Technical Manager of the Permutit Co., and A. D. Way has been appointed Chief Mechanical Engineer, according to an announcement by H. W. Foulds, President of the company.

H. L. Bechner A. D. Way

Mr. Bechner will be responsible for the company's technical policy on the application, guarantee, and performance of its zeolites, ion exchangers, deaerators, chemical feeds, degasifiers, and precipitation equipment. He will also serve as Chairman of the Engineering Committee.

Mr. Way as Chief Mechanical Engineer, will administer the Engineering Department and supervise the mechanical design and layout of equipment.

The *Key* to all Good METER BOX COVERS



The Ford Lifter Worm Lock is first of all a strong, secure lock to hold the lid tightly on the meter box, preventing accidents to pedestrians and damage to the meter.

The FORD WORM LOCK

When the meter reader places his key on the forged Everdur bolt and turns it the lid is forced upward by a powerful screw-jack action which breaks any seal of ice or dirt. *Then* with the lid unlocked the key is automatically attached to the bolt and serves as a handle for lifting. The action of locking automatically disengages the key. The meter reader doesn't need to touch the lid. For over 35 years the Ford Lifter Worm Lock has been proved and improved.

The Lifter Worm Lock is standard and exclusive on all Ford Meter Box Covers. Here are four of the 12 sizes of Type C Single Lid Covers.

SEND FOR OUR CATALOG

The
FORD METER BOX COMPANY, INC.,
WABASH, INDIANA

SPARLING METERS

FOR YOUR MAIN-LINES

FLANGED TUBES
2-inch to 36-inch

•

SCREW TUBES
2-inch to 6-inch

•

BELL & SPIGOT TUBES
4-inch to 36-inch

•

SADDLE MOUNTED
6-inch to 72-inch
For Iron, Steel, Wood, Concrete and Transite Mains

•

COMPOUND METERS
For all mains
6-inch to 36-inch
For flow-ranges as wide as 1 to 125

IF totalization only is needed, simply install the Sparling Meter in the line and read the register.

Indicators, Recorders and Controls can be added if, as and when desired.

We are glad to quote prices. It may surprise you to learn how little it costs to keep an accurate check on any main line!

Bulletin 309 comes upon request

SPARLING

Manufacturer of Water Measuring Equipment

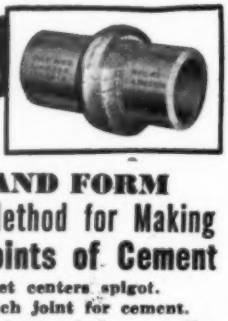
LOS ANGELES 54...Box 3277 Terminal Annex
CHICAGO 16.....3104 South Michigan Ave.
622 Broadway.....CINCINNATI 2
101 Park Avenue.....NEW YORK 17
BOSTON 8.....6 Beacon Street

BAILEY METERS AND CONTROLLERS

FOR SEWAGE TREATMENT AND WATER SUPPLY . . .

● Venturi Tubes, Weirs, Flumes, Nozzles and other primary elements; Mechanically and Electrically operated Registers and Complete Automatic Control Systems.

BAILEY METER COMPANY
1672 IVANHOE ROAD • CLEVELAND, O.
Bailey Meter Co. Ltd., Montreal, Canada

WESTON 

GASKET AND FORM
The Perfected Method for Making Sewer Pipe Joints of Cement

- No jute used—gasket centers spigot.
- Definite space in each joint for cement.
- Form confines cement-grout to lower portion of joint.
- Particularly advantageous in water-bearing trenches.
- Infiltration minimized.

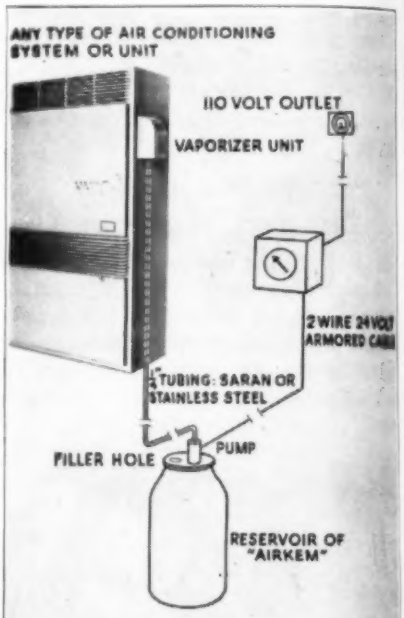
L. A. WESTON **Adams, Mass.**

Link-Belt Establishes Three Sales Offices

Link-Belt Co. of Chicago has established three new sales offices. The first at Moline, Ill., is located at 1608 Fifth Ave., and is in charge of M. J. Parykaza, as district sales engineer. The second at 730 Temple Bar Bldg., Cincinnati 2, Ohio, will be under the direction of L. R. Clark as district sales engineer. The third new office under the charge of C. C. Wiley is located at 823 Comer Bldg., Birmingham, Ala.

Airkem System for Odor Control Indoors

Perhaps it would be heresy to suggest that some sewage plants have odors and that these odors are objectionable indoors. But if odors there be perhaps the persons who work there might be interested in a new system for control of odor and freshness indoors. This system is announced by W. H. Wheeler, Inc., distributors of Airkem, the Chlorophyll-air freshener. The accompanying photograph shows the system for air conditioning units to be located in an office or laboratory.



SCHEMATIC DRAWING OF "AIRKEM" EVAPATROL UNIT

The Airkem Chlorophyll air freshener is composed of a complex group of aromatic substances from plants and activated chlorophyll. This is the same material which under the name "Air Wik" has been widely used for the control of cooking odors in household kitchens.

B. P. Spann Returns to Gardner-Denver Co.

B. P. Spann, Advertising Manager of the Gardner-Denver Co., Quincy, Ill., has returned to the company after service of more than 38 months in the Navy.

B. P. Spann

Mr. Spann, who has been with the Gardner-Denver Co. since 1934, was granted a leave of absence in November 1942 to enter the Navy. Stationed at the Aviation Supply Office in Philadelphia, he was Officer in Charge of Maintenance and Overhaul Spare Parts for all Navy transport aircraft. When he was discharged, Mr. Spann had the rank of Lieutenant Commander.

DeLaval Appoints J. P. Stewart Special Representative

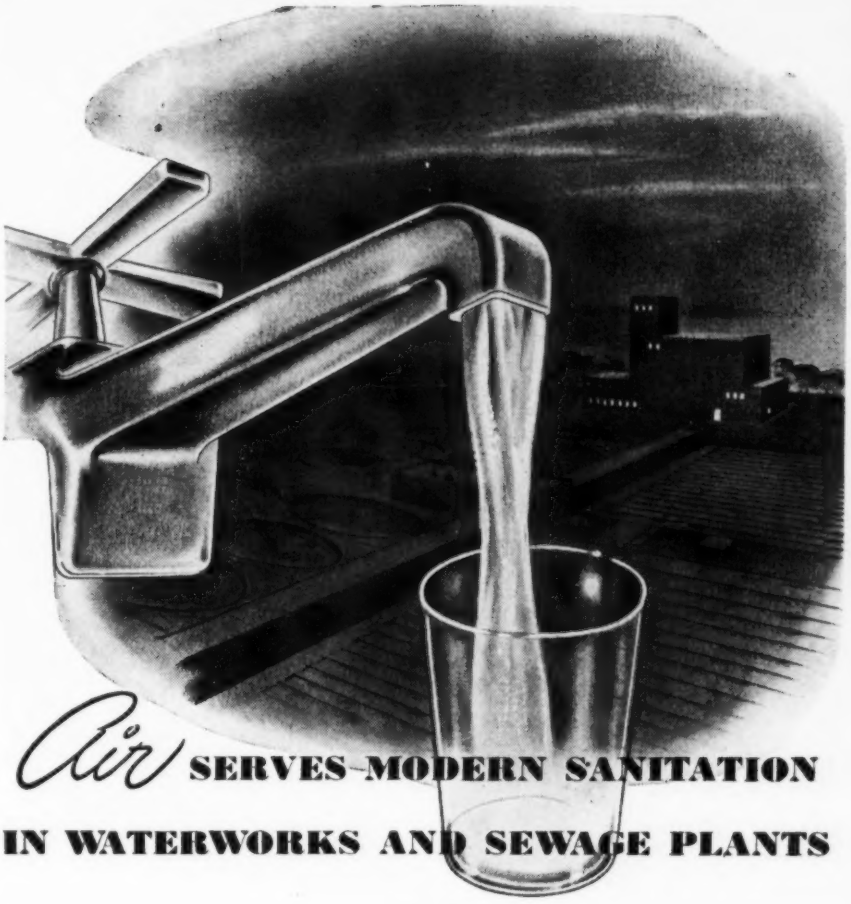
The DeLaval Steam Turbine Co. of Trenton, N. J., has announced the appointment of James P. Stewart as Special Representative for DeLaval

J. P. Stewart

Centrifugal blowers and compressors. Mr. Stewart was for many years connected with the Elliott Company of Jeannette, Pa., and more recently was assistant general manager of B-W Superchargers, Inc., in Milwaukee. As special representative for DeLaval Mr. Stewart will make his headquarters in Trenton.

Prufcoat Protective Coatings

Prufcoat is a protective coating which may be obtained in six colors; three different grays besides buff, tile red, and black. According to the



Air SERVES MODERN SANITATION IN WATERWORKS AND SEWAGE PLANTS

• Even the most modern waterworks can't guarantee freedom from stream pollution. Complete modern sanitation demands adequate sewage disposal plants to maintain safe natural sources.

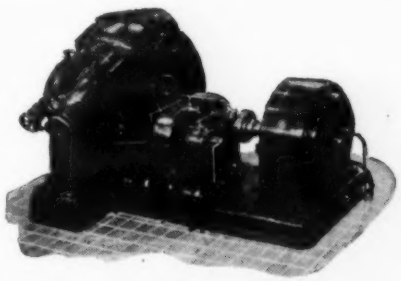
In both waterworks and sewage disposal plants, air has important work to do. In water treatment, air helps reduce odor and improve taste. In sewage treatment, air is used for agitation, mixing chemicals, removing grease and providing oxygen for purification.

Roots-Connersville blowers supply this necessary air for many municipal plants. Engineers select them because of their long-proved low operating costs. Their sound engineering and sturdy construction account for the profitable use of R-C blowers or gas pumps in such widely varying work as:

Steel converters — *Oil refining* — *Bottle and tube filling*
Paper making — *Yarn drying* — *Heat treating and annealing*
Mixing gases — *Coal treating* — *Feather picking machines.*

The *dual-ability* of Roots-Connersville to engineer and build blowers to meet your specific requirements is at your service. Whenever you need to move air, gas or liquids under moderate pressures, consult us without obligation.

ROOTS-CONNERSVILLE BLOWER CORP.
One of the Dresser Industries
606 Mount Ave., Connersville, Indiana



The same engineering skill is built into the smallest Roots-Connersville blower as is built into this large motor-driven unit in a modern sewage disposal plant.

Roots CONNERSVILLE SINCE 1854

ROTARY POSITIVE AND CENTRIFUGAL BLOWERS • EXHAUSTERS • BOOSTERS
LIQUID AND VACUUM PUMPS • METERS • INERT GAS GENERATORS

The *Coagulant* that *Cuts Costs!*

TENNESSEE CORPORATION
Ferri-Floc

Ferri-floc . . . the ferric coagulant that is successfully and economically used in sewage treatment throughout the United States. Take advantage of modern plant research and findings: use Ferri-floc. Tennessee Corporation's technical staff will be glad to help you with your specific problems. Write to us today. The consultation service is free, of course.

The Mark of Quality
TC
TENNESSEE CORPORATION

Tennessee Corporation
ATLANTA, GEORGIA LOCKLAND, OHIO

ZECO GREENSAND ZEOLITE

ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.

ZEOLITE CHEMICAL CO.
Sales Office 140 Cedar St. New York, N. Y. Factory Medford, N. J.
Pioneer Producer of GREENSAND ZEOLITE MINERAL

BOND-O
Sulphur Joint Compound

Our BETTER BLENDING means that each batch of BOND-O comes out of our machines exactly compounded and thoroughly mixed. Cast iron pipe joints made with BOND-O show this difference. Less initial leakage from every joint made.

NORTHROP & COMPANY, INC.
50 CHURCH STREET
NEW YORK 7, N. Y.

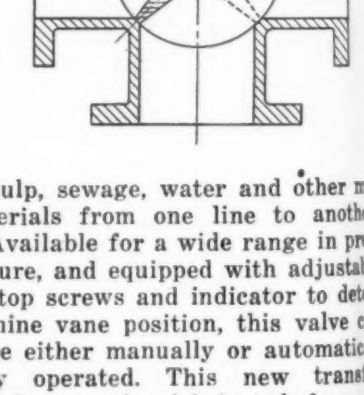
manufacturer, Prufcoat gives positive protection against acids, alkalies, oil, and water. It is one material for use on all concrete, structural steel, floors, pipes, tanks, machinery, and equipment which are subject to corrosion or deterioration from any cause.

Prufcoat may be used either inside or outside. Because of the fact that the Prufcoat film formed after polymerization has virtually a zero acid number, saponification number, and water absorption rate, it is one coating which will serve for a number of services. Prufcoat is made from a special combination of synthetic resins and inert pigments. It may be applied by brush or spray gun and dries by evaporation of the volatile solvents. Subsequent polymerization provides the tough, non-oxidizing film which is completely acid—, alkali—, oil—, and water proof.

Further information may be obtained by writing Prufcoat Laboratories, Inc., 50 E. 42nd St., New York 17, N. Y.

Four-Way Transfer Valve

R-S Products Corp. of Philadelphia has introduced a new 125 pound, single vane, quick-operating control valve to be used in the transfer of chemicals, oil, paper



pulp, sewage, water and other materials from one line to another. Available for a wide range in pressure, and equipped with adjustable stop screws and indicator to determine vane position, this valve can be either manually or automatically operated. This new transfer valve can be fabricated from all types of metals in sizes from 4 to 72 inches. One particular metal used is R-S "A" metal, a tough, dense metal of uniform grain and high endurance limit which resists galling, wire drawing, and the wearing action of abrasive materials.

Savannah, Ga., Dewaters Ground to Lay a Sewer

Caterpillar Tractor Aids Project

In order to eliminate underground water which causes deterioration of pavements, Savannah, Ga., has launched a program of sewering. Before the sewers can be laid, however, the ground must be drained, for the ocean is but 500 feet away.

The ditching job is accomplished in the following manner: A portable crane drives holes with a sand point, powered by a strong stream of water under pressure fed through a flexible hose. Then well points are installed to drain the water from the subsoil before the ditch digging can be initiated. The crane operates off a rear power takeoff of a "Caterpillar" Diesel D7 tractor. The dewatering system is shown in the accompanying photograph.

Mathieson Expands Research Facilities

In line with its program of expanding production and research facilities, The Mathieson Alkali Works is to build a new pilot plant at Niagara Falls, N. Y., according to the company president, George W. Dolan.

Construction will get under way as soon as real estate negotiations are concluded. Expected to cost $150,000, the pilot plant building will be the second recent addition to the company's facilities at Niagara Falls. Completion of another plant in that city, for increased production of sodium chlorite, was announced last September.

Bristol Bellows Differential Flow Meters

The Bristol Co. has announced a new bellows differential flow meter

Meet Summertime Needs Easily

Are you ready to meet the higher water demand this summer? An N-Sol Process can help you at peak flow. Rates 25% above nominal capacity are frequently obtained with high quality.

This is possible because N-Sol insures faster floc formation and a heavier, tougher floc. Now is the time to look into the use of the N-Sol Process to step up your capacity. Samples of activated silica sols for jar tests furnished free on request.

These processes fit any coagulating procedure:

N-Sol-A*—N Brand Silicate reacted with ammonium sulfate. Used where chloramine sterilization is desired.

N-Sol-B—N Brand reacted with alum. Used with any sterilization procedure. (U.S. Pat. 2,310,009)

Baylis Sol—N Brand Silicate reacted with sulphuric acid. Used with any sterilization procedure. (U.S. Pat. 2,217,466)

*Patent Applied For

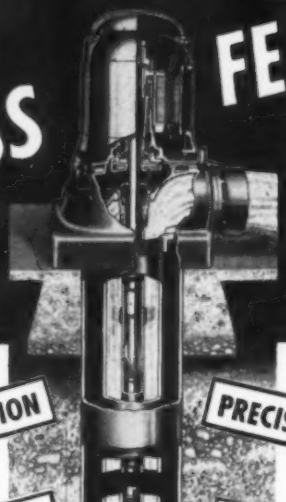
N-SOL PROCESSES FOR WATER COAGULATION

DEVELOPED AND PATENTED BY
PHILADELPHIA QUARTZ COMPANY, PHILADELPHIA 6
AVAILABLE UNDER LICENSE WITHOUT CHARGE

10 PEERLESS FEATURES

AT NO EXTRA COST

ADD EXTRA LIFE



NO CORROSION

PRECISION SHAFTING

SMOOTH STARTING

CLOSER TOLERANCES

BRONZE BEARINGS

DOUBLE IMPELLER SEAL

LESS HYDRAULIC LOSS

DOUBLE BOWL BEARINGS

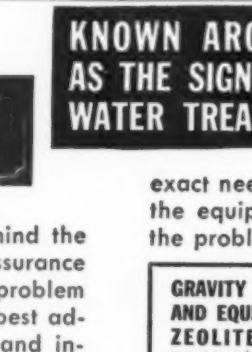
CONTINUOUS LUBRICATION

FULLY ENCLOSED IMPELLERS

Peerless OIL-LUBRICATED Vertical Turbine Pumps produce up to 30,000 g.p.m., from wells 4" in diameter and larger. Also available with water lubrication.

PEERLESS PUMPS

PEERLESS PUMP DIVISION
Food Machinery Corp.



FACTORIES
LOS ANGELES 31, CALIFORNIA
301 West Avenue Twenty-six
QUINCY, ILL. ★ CANTON 6, OHIO

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

KNOWN AROUND THE WORLD AS THE SIGN OF EXCELLENCE IN WATER TREATMENT EQUIPMENT

The years of experience behind the Roberts nameplate is your assurance that any water rectification problem is expertly handled to your best advantage. As manufacturing and installation engineers, the Roberts organization is equipped to meet your exact needs regardless of the size of the equipment or the complexity of the problem.

GRAVITY FILTERS • SOFTENING PLANTS AND EQUIPMENT • PRESSURE FILTERS ZEOLITE SOFTENERS • SWIMMING POOL RECIRCULATING APPARATUS SPECIAL WATER TREATMENT EQUIPMENT.

We invite your inquiries

ROBERTS FILTER MANUFACTURING COMPANY • *Darby, Pa.*

which requires no mercury. The new meter is described in bulletin F1603, just released, which shows a cross section drawing of the meter body and the unique method used to transmit bellows motion to the pen arm. The meter body shaft is completely isolated from the measured fluid.

Further information on the new meter may be obtained by writing for Bulletin F1603 to the Bristol Co., Sales Promotion Dept., Waterbury 91, Conn.

Electronic Potentiometer-Pyrometer

The Bailey Meter Co. has developed a new electronic potentiometer-pyrometer which has no continuously

moving or vibrating parts in its measuring circuit. It records one or two temperatures on a 12 inch diameter uniformly graduated chart. It is an indicating, recording, and controlling instrument, operating from thermocouples for temperatures up to 3000 deg. F.

Additional information may be obtained from the Bailey Meter Co., 1050 Ivanhoe Road, Cleveland, 10, Ohio.

E. S. Powell Represents Varec in Chicago

The Vapor Recovery Systems Company has announced that E. S. Powell has been appointed sales manager for the Great Lakes territory, with offices at 122 S. Michigan Ave., Chicago. Mr. Powell was recently discharged from the United States Navy, where he held the rank of Lieutenant. Prior to that time, he was a safety engineer with insurance underwriters.

LITERATURE AND CATALOGS

Non-Surge Valves

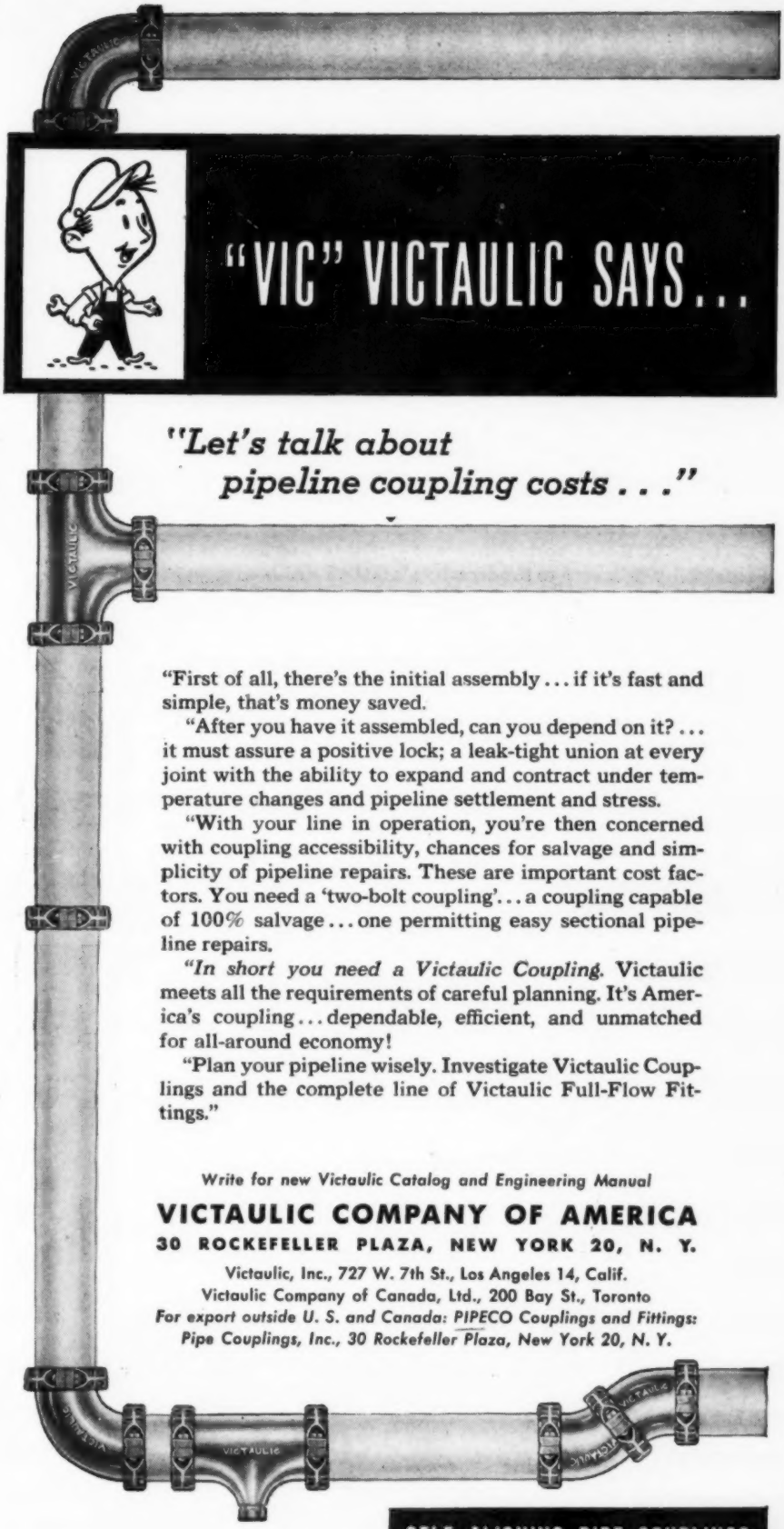
One of the exhibits we saw at the AWWA Convention in St. Louis was the new and interesting **Clayton Non-Surge Valve** for pump discharge lines. This unit is now described in a recently released bulletin of that name. Clayton Manufacturing Co. has issued this bulletin CV-131 in which is diagrammatically shown the sequence of operations of the Clayton No. 54-P Non-Surge Valve. The bulletin also lists pertinent data and construction details on the valves and may be obtained by writing the Clayton Manufacturing Co., Alhambra, Calif.

Protective Coatings

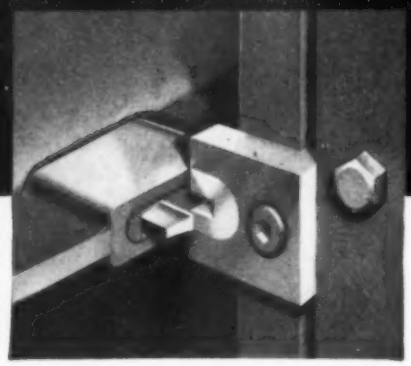
In a catalog titled, *Reilly Protective Coatings*, one might expect to see photographs of pipe lines of all kinds, as well as various types of structures which are in need of protective coating.

True to one's expectations, this catalog from the Reilly Tar and Chemical Corp. does contain pictures of oil, gas and gasoline transportation lines, water transportation lines, water works systems, gas tanks, water storage tanks, penstocks, and warehouse floor among other things. Listed on the first page are the various Reilly protective coatings, including pipe enamel and primer, cold application No. 40, cold application No. 5, cold application No. 50, Resiscote, available in colors for metal and concrete surfaces, Crecote paint available in colors for creosoted wood block floors, etc., as well as bituminous pipe dip compound for hot dipping and cast iron pipe and fittings.

Photographs show that the primer and the enamel, which insures dependable protection for pipes of all sizes, may be readily applied at the mill or in the field. Reilly enamel is manufactured in two standard grades and a table shows the various characteristics of the enamel. Pictures show typical applications of Reilly enamel as well as typical applications of cold application coatings. The final page in the catalog shows a map locating the various operations of the company and opposite


"VIC" VICTAULIC SAYS...
"Let's talk about pipeline coupling costs . . ."
"First of all, there's the initial assembly . . . if it's fast and simple, that's money saved.
"After you have it assembled, can you depend on it? . . . it must assure a positive lock; a leak-tight union at every joint with the ability to expand and contract under temperature changes and pipeline settlement and stress.
"With your line in operation, you're then concerned with coupling accessibility, chances for salvage and simplicity of pipeline repairs. These are important cost factors. You need a 'two-bolt coupling'... a coupling capable of 100% salvage... one permitting easy sectional pipeline repairs.
"In short you need a Victaulic Coupling. Victaulic meets all the requirements of careful planning. It's America's coupling... dependable, efficient, and unmatched for all-around economy!
"Plan your pipeline wisely. Investigate Victaulic Couplings and the complete line of Victaulic Full-Flow Fittings."
Write for new Victaulic Catalog and Engineering Manual
VICTAULIC COMPANY OF AMERICA
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.
Victaulic, Inc., 727 W. 7th St., Los Angeles 14, Calif.
Victaulic Company of Canada, Ltd., 200 Bay St., Toronto
For export outside U. S. and Canada: PIPECO Couplings and Fittings: Pipe Couplings, Inc., 30 Rockefeller Plaza, New York 20, N. Y.
Have you considered Victaulic for your piping requirements?
Sizes—¾" through 60"
SELF-ALIGNING PIPE COUPLINGS
VICTAULIC
EFFICIENT FULL-FLOW FITTINGS
Copyright 1946, by Victaulic Co. of America

This GRIDUCTOR tooth helps improve Sewage Plant efficiency



As this GRIDUCTOR tooth and others like it mesh with a series of cutting bars, sewage solids are carefully cut and screened . . . a step that brings many advantages in the processes that follow.

Because they protect other treatment units from fouling and clogging; *because* their cutting action improves sedimentation in the primary clarifier; *because* GRIDUCTOR-cut solids increase total solids delivered to the digester; *because* this increase in solids in the digester leads to the production of more gas; GRIDUCTORS are proven aids in economical and dependable sewage plant operation.

These GRIDUCTOR advantages are combined with ease of installation in existing screen channels. These advantages explain why GRIDUCTORS have become a really important unit in so many sewage plants. They explain why GRIDUCTORS will continue to be installed in larger and larger numbers where uninterrupted plant service is an essential. The GRIDUCTOR is another product of Infilco research. Ask for more details. INFILCO INC., 325 West 25th Place, Chicago 16. Illinois.

CONSULT INFILCO — FIRST IN WATER AND SEWAGE TREATMENT

MORE WATER —LESS WORRY

by CLEANING your WATER MAINS using The NATIONAL METHOD

No need to worry about reduced water main capacities just when you need every gallon you can pump. Do as many other communities — large and small — are doing: clean those old clogged up mains by using the NATIONAL METHOD of water main cleaning.

We offer you (1) greater volume of water; (2) lower pumping costs; (3) improved pressure; (4) cleaner water and (5) reduced insurance rates.

Before Cleaning

The NATIONAL METHOD

After Cleaning

GUARANTEED TO RESTORE 95% ORIGINAL CAPACITY

The National Water Main Cleaning Co.

50 Church St. Branches: New York 7

115 Peterboro St., Boston 15, Mass.
P. O. Box 749, Mayaguez, Puerto Rico
7103 Dale Ave., St. Louis 17, Mo.
3707 Madison St., Kansas City 2, Mo.
3812 Castellar St., Omaha 5, Neb.
P. O. Box 683, Jacksonville 1, Fla.
205 West Wacker Dr., Chicago 6, Ill.
501 Howard St., San Francisco, Cal.
2028 Union Ave., Montreal, Can.
576 Wall Street, Winnipeg, Canada

is a list of all Reilly products. The catalog may be obtained from Reilly Tar & Chemical Corp., Indianapolis, Ind.

Rotary Type Pumps

"Rotary type positive displacement pumps may be used for moderate or low viscosity liquids under medium pressure." So says a new bulletin **"Streamflow" Rotex Pumps** released by the Quimby Pump Division of H. K. Porter Company, Inc. This folder contains complete specifications, dimensions and performance charts on these Quimby Rotex Pumps, which are constructed in either gear-in-head design or external gear and bearings. The catalog also lists a number of applications of the pumps, running from non-lubricating and viscous liquids, such as acids, to varnishes and other innumerable materials including fuel oil, gasoline, lubricating oil, coolants, etc.

Copies of the "Streamflow" Rotex Pump bulletin may be obtained from the Sales Department, Quimby Pump Co., 342 Thomas Street, Newark, N.J., or the nearest Porter-Devine-Quimby district office.

Water and Sewage Works Equipment (By Builders)

Under the title, **Water and Sewage Works Equipment,** Builders-Providence Co. of Providence, R. I., has recently issued a 4-page folder listing and showing the various types of water and sewage works equipment manufactured by the company. These include the differential producers, filter controller, Propeloflo meter, Flo-watch, filter controller, Chronoflo telemeter, recorders, filter gauges, large dial gauges, Flo-gauges, conveyor scale, manometers, ratio indicating gauges, Kennison Nozzles and other auxiliary equipment. Write to Builders-Providence, Inc., (Div. of Builders Iron Foundry), Providence 1, R.I. for bulletin No. 358.

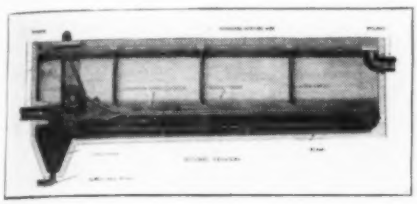
Pitot Equipment

If you want to know how to use a Simplex pitot tube or how to take care of a portable pitot recorder, or if you are interested in the theory,

formulae, notations, tables and curves used with Simplex Pitot tubes, manometers and recorders, write for **Simplex Pitot Equipment** (Data Section). This Bull. No. 50 gives complete details on the answers to these questions. A copy will be sent upon request to Simplex Valve and Meter Co., 6743 Upland Street, Philadelphia 42, Pa.

Rex Verti-Flo Thickener

The Chain Belt Co. of Milwaukee has announced that it is now manufacturing the Rex Verti-Flo Thickener, a new vertical flow slurry blanket type of thickener. This item was originally shown in the Review of Developments in Water Supply in 1945 by Leonard N. Thompson in the January 1946 issue of *Water & Sewage Works*.



This thickener employs a unique cellular construction obtained by dividing the conventional sedimentation basin with proper weirs and baffles. Long weir length is obtained with this design, which utilizes Rex Conveyor Sludge Collectors.

For details on the Rex Verti-Flo Thickener, write Chain Belt Co., 1600 W. Bruce St., Milwaukee 4, Wis.

Air Release—Pump Priming

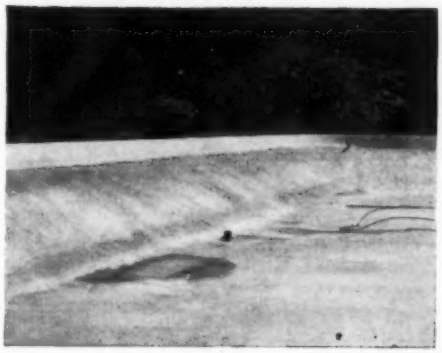
If you have never had to prime a pump, or think you never will, read no further. But, if you have either an air release problem or pump priming problem you will be interested to know that Valve and Primer Corp. has a bulletin on **APCO and V-APCO Air Release Valves and Pump Primers.** This bulletin tells what the APCO Pump Primer is, shows pictures of how it works, and gives information on how to select a primer. The bulletin also contains information on air and vapor release valves. The company also makes a hydraulic valve operator, and a valve position indicator.

Write to Valve and Primer Corp., 111 W. Washington St., Chicago 2, Ill., for this folder on the subject of pump priming and air release.

CEMENT GUN COMPANY

"GUNITE" CONTRACTORS

GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.



OLD RESERVOIR MADE BETTER THAN NEW

with "GUNITE" lining placed over the original lining.

The two pictures show the reservoir belonging to the Borough of Hellertown, Penna. The upper view shows the "GUNITE" work in progress, and the lower view the completed lining.

This old concrete lined reservoir was badly cracked and disintegrated, with considerable leakage.

We chipped out the disintegrated concrete, sandblasted the entire area, and placed a minimum of two inch "GUNITE" reinforced with heavy mesh.

This reservoir is now water-tight and better than new.

Our 72-page bulletin C2300 describes many reservoir jobs and scores of other uses of "GUNITE."

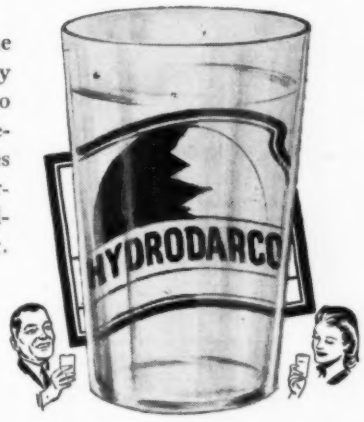
Write for your copy of bulletin C2300.

MANUFACTURERS OF THE "CEMENT GUN"

It's a Clear and Clean Proposition

GOOD WATER MAKES SATISFIED CUSTOMERS

You can win and hold the good will of your public by standardizing on Hydrodarco for water purification. This special activated carbon eliminates odors and bad-tasting impurities with absolute dependability at surprisingly low cost.



HYDRODARCO

DARCO CORPORATION

60 EAST 42ND ST., NEW YORK 17, N.Y.

The TATE Cement Lining Process
Restores efficiency of old Water Mains

Now is the time to investigate the Tate Cement Lining process —and see what it can do to restore the efficiency of your old water mains.

View showing Tate Process in Pipe Joint. Note thoroughness of Lining.

Write for Literature.

What the TATE Process accomplishes

1. Water mains cleaned and cement-lined without removing pipe.
2. Eliminates discoloration and further cleaning costs.
3. Reduces pumping costs.
4. Restores reduction in head and flow co-efficients. This means full fire protection and lowered insurance rates.
5. All joints cement-lined . . . just one continuous pipe.
6. Does the job without interruption of service to consumer.

TATE PIPE LININGS, Inc.
ANDOVER, MASS.

84" pipe—Spring Lake, N. J.

FLANGED PIPE

FLEXIBLE JOINT PIPE

BELL & SPIGOT PIPE

SPECIAL CASTINGS

SHORT BODY BELL & SPIGOT SPECIALS

Large stock enables us to make prompt shipments.

CAST IRON PIPE

SIZES 2" TO 84"

Warren Foundry & Pipe Corp.

11 Broadway, New York

Warren Pipe Company of Mass., Inc.

Chlorination Instruction Book

Step right up, folks, and get your copy of **Perchloron,** the 50 page bulletin published by the Pennsylvania Salt Co., to tell you about swimming pool sanitation, water purification, sewage disposal, and disinfection. "It's new, it's different—it's free!"

In addition to the introduction which explains what high test hypochlorites and available chlorine are, the booklet contains quite usable information on the advantages of Perchloron, and how to prepare and feed solutions of the material for the various uses named above.

Write to Pennsylvania Salt Co., 1000 Widener Building, Philadelphia 7, Pa., and tell them this "barker" aroused your desire for a copy.

Magnetic Drive

You might not believe it, but the **E-M Adjustable-speed Magnetic Drive** is used in water and sewage works. In fact one of the 40 illustrations in a new booklet by that name, No. 183, published by Electric Machinery Mfg. Co., shows the installation of these magnetic drives on induced draft fans for sewage drying at the Chicago Sanitary District plant. These E-M magnetic adjustable speed drives are used for boiler draft fans, centrifugal pumps, centrifugal blowers, compressors, and other loads where torque required decreases with reduction of speed.

In Bulletin No. 183 the principles of operation, performance characteristics and applications of the drive are described and illustrated. This bulletin shows that the magnetic adjustable speed drive is an electromagnetic torque transmitter, placed between a constant speed motor and the equipment to be driven, in order to provide easily adjustable, micro-step, wide range control of speed.

Bulletin 183 is published by the manufacturers of the equipment, the Electric Machinery Mfg. Co., Minneapolis 13, Minn.

Up-Flow Coagulation

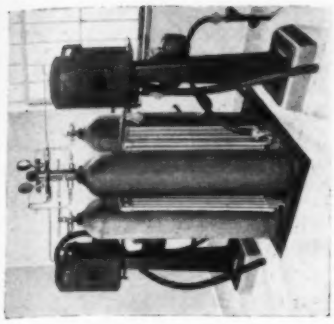
In a new bulletin issued by the Gråver Tank Co., charts, flow diagrams, cut-away drawings show how the **Graver Sludge Blanket Type Reactivator** may be used to

CHEMCO CHLORINATORS

CHEMCO CHLORINATORS

for

MUNICIPAL INSTALLATIONS



The efficient, continuous, automatic operation of CHEMCO CHLORINATORS in municipal and private installations for nearly a quarter of a century is proof of their extremely high quality and dependability. Illustration shows a CHEMCO CHLORINATOR installation in State of New York Institution Sewage Plant. CHEMCO CHLORINATORS provide the answer in every type of installation where chlorination is necessary. Send for bulletins Nos. 300-1, 300-3, 300-5 for full information on exclusive CHEMCO features.

CHEMICAL EQUIPMENT CO.

Main Office & Factory: 223 Center St., Los Angeles 54

REPRESENTATIVES IN PRINCIPAL CITIES

soften and clarify raw water. According to this 8 page illustrated booklet, which explains the principles and advantages of upward sludge filtration, this type of equipment can materially reduce reaction time, and provide a treated water that may be suitable for process use without further treatment in many cases.

A copy of the bulletin may be obtained by writing Graver Tank and Mfg. Co., Inc., 332 South Michigan Ave., Chicago, Ill.

J-M Products for Sewage Works

In a two-part brochure containing 78 pages, the Johns-Manville Co. has presented more than a hundred photographs of actual installations of Johns-Manville products in sewage works throughout the country. Titled, **Products for the Sewage Works Industry** this is a companion brochure to the one for water works and as in that one, all photographs are labeled as to location.

This brochure shows such products as insulators for digesters, gaskets for chlorine lines, ventilators, sewer pipe of Transite, Asbestos-Ebony control panels and instrument boards, Chemstone for gates and laboratory table tops, acoustical sheets, building sheets, waterproofing materials and refractories for sludge incinerators.

The second half of the bulletin is the J-M catalog containing descriptions of the materials illustrated in Part I. The book is free for the asking. Write for Brochure TR-38A and address your request to Johns-Manville, Box 290, New York 16, N. Y.

Liquid Chemical Feeder

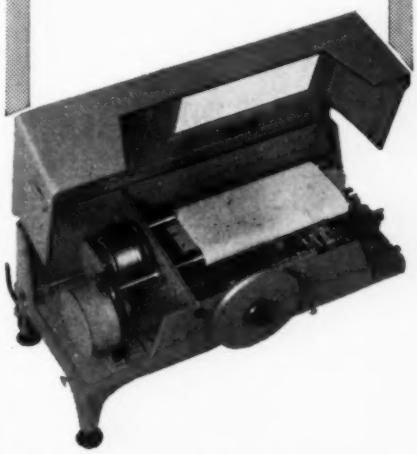
"Say It with Numbers" is the theme of a sixteen page bulletin on the **Var-I-Feeder,** produced by the Chemical Feeders Division of Morse Boulger Destructor Co. The "numbers" on the Var-I-Feeder are the numbers on the tachometer dial which shows accurately how fast the feeder is pumping and therefore how much chemical is being fed.

This catalog describes the fast stroking principle of operation of this feeder, giving a rapid rate of injection. Typical installations of the feeder are shown where the feeder is being used for chemicals

L&S

STEVENS WATER LEVEL RECORDER

Type A35



FIRST developed in 1911, the Stevens *Type A* Recorder is used the world over. Fundamental principles of the instrument are the use of a continuous chart and an unlimited range of stages.

The *Type A35* consists essentially of a height element mechanism to register elevation of water surface above a chosen datum to a convenient scale, plus a time element mechanism to move a chart at a conveniently uniform speed. Visible graph strip charts 10″ or 20″ wide (also corresponding metric charts) . . . Weight-driven clock (synchronous electric clocks available on order) . . . Non-corrodible metal used throughout . . . One-piece protective hinged cover . . . The *Type A35* is adaptable to remote registration. Write for Bulletin No. 12.

LEUPOLD & STEVENS INSTRUMENTS

Manufacturers since 1907

PORTLAND 13, OREGON

Hydrographic • Surveying • Navigation
Automatic Controls

Leupold & Stevens Instruments
4445 N. E. Glisan St., Portland 13, Oregon

Please send Bulletin No. 12 on the Stevens *Type* A35 Recorder.

Name _____

Organization _____

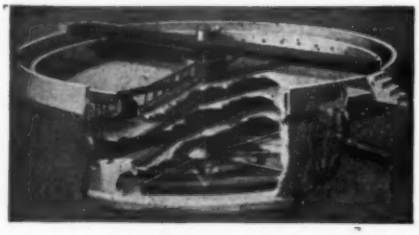
Title _____

Street _____

City _____ *Zone* *State* _____

AMERICAN GAS BOILERS
STEAM AND WATER TYPES
for Digester Heating
FOR RATINGS AND DATA SEE OUR PAGE IN THE 1946 ANNUAL REFERENCE SECTION
American Radiator & Standard Sanitary Corporation, Pittsburgh 30, Pa.
AMERICAN-Standard
HEATING PLUMBING
Serving the Nations' Health and Comfort
SALES OFFICES IN PRINCIPAL CITIES

CONTACT
LAKESIDE ENGINEERING CORPORATION
Chicago 6 Illinois
222 West Adams St.
FOR
WATER SOFTENING by the Zeolite or Lime-soda methods.
WATER FILTERING to remove Suspended solids, color, odor or taste.
SEWAGE TREATMENT by the Aero-filter which offers all of the advantages of other types of trickling filters plus better momentary distribution.
Spiraflo Clarifier for improved clarification, including scum and oil removal.



P.F.T. Clarifiers for Rapid Precipitation of Sewage Solids

The P.F.T. Tray Clarifier embodies a design which affects the continuous rapid separation of the solids and liquid in sewage; and the immediate removal of the clarified effluent. A series of shallow settling areas over which the sewage is spread assures speedy precipitation. Its high rate of flow provides maximum capacity in minimum space; reducing the construction and operating costs of clarification equipment.

Write for Bulletin No. 210 containing complete information, including operating results.

P.F.T. Pacific Flush-Tank Company
4241 Ravenswood Ave., Chicago, Ill.
New York Charlotte, N. C.

GATE VALVE OPERATION
★ SAFE ★ RELIABLE ★ QUICK ★
By
The Dean Truck Mounted Valve Operator
Write for Literature
PAYNE DEAN & CO. P.O. Box 271 MADISON, CONN.

of different character and purpose in water and sewage works. Also included in the catalog is a discussion of reagent head construction, and many Var-I-Feeder innovations such as automatic air relief vent, transparent illuminated head, and many other features. The Var-I-Feeder may be obtained in either proportional meter controlled design or in constant rate design, both of which are shown in the catalog.

Write to Chemical Feeders Division, Morse Boulger Destructor Co., New York 17, N. Y., for Bulletin Var-I.

Magnesium for Cathodic Protection

The Dow Chemical Co. of Midland, Mich., has published a 13-page booklet dealing with the use of **Magnesium Anodes for Cathodic Protection.** In addition to many illustrations, the booklet contains descriptive information regarding this method of corrosion control along with answers to many of the questions generally asked concerning this subject.

Write to the Magnesium Division, The Dow Chemical Co., Midland, Mich., for copies of this booklet.

Portable Generators

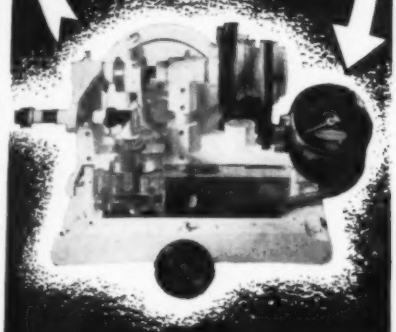
Portable Power for Any Job is the theme of a folder on **Homelite Portable Gasoline - Engine - Driven Generators.** Light in weight, but built for heavy duty, these portable electric plants may be obtained in a variety of models from 48 to 142 lbs. in weight.

The folder describing these units may be obtained from the Homelite Corp., Port Chester, N. Y.

Manometers

Have you a little flow measuring problem in your plant, or do you want to make a water survey? If so, remember that manometers are one means of making flow rate measurements. Bull. No. 200, titled **Simplex Manometers** describes completely a line of fixed and portable manometers for this use. Also included are engineering data on manometers. Bull. No. 200 may be obtained from Simplex Valve and Meter Co., 6743 Upland Street, Philadelphia 42, Pa.

IT'S THE TACHOMETER THAT COUNTS



for A-C-C-U-R-A-T-E Chemical Feeding

VAR-I-FEEDER
"Says It With Numbers"

Serves in
- Alum Feeding
- Caustic Dosage
- Hypochlorination
- Aqua Ammoniation
- Soda Ash Treatment
- Swim Pool Water Treatment
- Calgon for Corrosion Control

CHLORINE DIOXIDE PROCESS FOR TASTE AND ODOR CONTROL
Sterilization with HTH, Perchloron, Pittchlor or Bleach

CHEMICAL FEEDERS DIVISION
MORSE BOULGER DESTRUCTOR COMPANY

Room 1700B — 205 E. 42nd St.

NEW YORK 17, N. Y.

Mechanical Mixing Equipment

Whether it be in a water plant employing coagulation, or in a sewage plant employing flocculation or aeration, **Mechanical Mixing Equipment** is of utmost importance. Pictured and described in Bulletin No. 4501 of the Ralph B. Carter Co. are several units of mixing equipment, including aerator drives, slow mixers, floc formers, vertical floccers, rapid mixers, mechanical mixers, and aerator paddles. This four page bulletin may be obtained from the Ralph B. Carter Co., Hackensack, N. J.

The Plumber's Ladle

In the February, 1946, issue of *The Ladle*, the official publication of the New York State Assoc. of Master Plumbers, appears an article on "Moral Responsibilities Governing Cross -Connections" by John R. Murdoch, Jr., Principal Attorney of the American Water Works and Electric Co., Inc., of New York. In an editor's note following the article it is pointed out that Mr. Murdoch's article was first published in August, 1945, in *Water Works & Sewerage* under the title "Cross-Connection Rules." The editor also states that "*The Ladle* regards water pollution as a matter of serious concern . . ." and points out that this is the third article to appear in a series on matters of public health and stream pollution.

Coming issues of *The Ladle* will feature other outstanding stories on river and stream pollution by other leading specialists in sanitary engineering.

In another section of *The Ladle* there appears an item on Waterworks and Sewerage Systems as taken from *The Valve World*, published by the Crane Co. This is a reprint of the section of the 90th Anniversary number of *The Valve World* in which the Crane Co. reviewed their part in various industries throughout the country, including water supply and sewage disposal.

The Ladle also prints a chart taken from *The Faucet*, published by the Wolverine Brass Works, which shows that the life expectancy in ancient Rome was 25 years; in 1700, 33 years; in 1850, 40 years; in 1900, 50 years, and today in the age of speed and science, if a man stays out of the way of an automobile, a

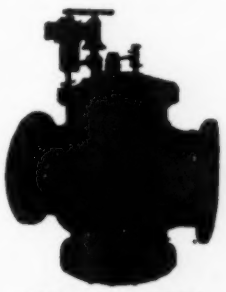
· 1879 ·
ROSS
AUTOMATIC VALVES

ALTITUDE VALVES • SURGE • RELIEF • BACK PRESSURE VALVES

FLOAT VALVES • REDUCING AND REGULATING VALVES

ALTITUDE VALVES
for
Control of elevation and heads into and out of tanks, basins and reservoirs, hydraulic control.
1. Single acting.
2. Double acting.
3. Combination assembly for three or more automatic operations.
4. Can be equipped with electric and manual controls.

COMBINATION VALVE
This valve will permit flow in one or both directions acting as
1. Pressure Reducing and Relief Valve.
2. Pressure Reducing and Altitude Valve.
3. Relief and Altitude Valve.



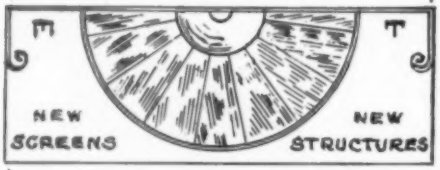
REMOTE CONTROL VALVE
Electric remote control—solenoid or motor can be furnished.
Adapted for use as primary or secondary control on any of the hydraulically controlled or operated valves.

ROSS VALVE MFG. CO.
INCORPORATED
P. O. BOX 595, TROY, N. Y.

railroad train, and otherwise avoids accidents, his life expectancy is 64 years. Pure water has played its part in this.

The Ladle, which was established in 1925 and is published in the interest of the plumbing and heating industry, is issued at 1622 Grand Central Terminal, 70 E. 45th St., New York 17, N. Y.

FINE SCREENS
FOR
SEWAGE
AND
INDUSTRIAL WASTES
TREATMENT



FORMER CONCEPTIONS
COMPLETELY OUTMODED

NO COSTLY, POWER CONSUMING REVOLVING BRUSH ARMS—25% GREATER SUBMERGED AREA.

NEW SCREEN PLATES FOR THE ECONOMICAL USE OF A FILTER MEDIA ON THE SCREEN, THUS INSURING GREATER REMOVALS THAN POSSIBLE HITHERTO.

COMPLETELY AUTOMATIC CONTROL POSITIVE SEAL RINGS.

MODERN DESIGN
HIGHEST EFFICIENCIES
LOWEST COST

SANEQUIPMENT ENGINEERING
2843 WHITEWOOD AVE.
ANN ARBOR, MICHIGAN

DESIGNERS — CONSULTANTS

WANTED — SUPERINTENDENT

For growing suburban water district near Seattle. Applicant should have sufficient knowledge of water engineering to supervise entire system and should have supervisory ability. Please furnish data regarding experience and education. Ability more important than long experience. Water District No. 68, Bellevue, Wash.

EQUIPMENT FOR RENT

Have almost complete chemical-bacteriological laboratory. Would like to put it to use with professional services assisting manufacturing or engineering firm. Could be moved and reassembled. If moved, prefer East. Box 2110, Water & Sewage Works, 330 So. Wells St., Chicago 6, Ill.

POSITION WANTED

As chemist and bacteriologist or manager of a small or medium sized water works. Thoroughly qualified, 22 years' experience. Technical courses in electrical engineering, water purification, water supply, water softening, hydraulics and chemistry. Nine years part time work at evening engineering school. No degree. Good worker and organizer capable of getting along with others. Box 2009, Water & Sewage Works, 330 So. Wells St., Chicago 6, Ill.

LEADITE
The Pioneer Self-Caulking Material for C.I. Pipe

W N S E

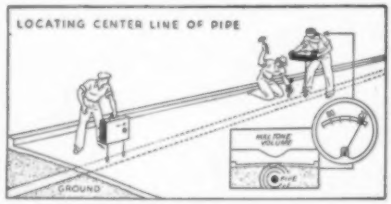
USED MOST EVERYWHERE!

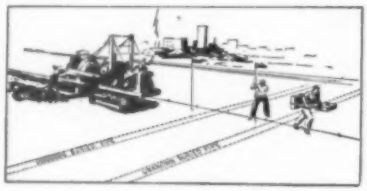
Hundreds of water works men have used Leadite . . . saved with Leadite . . . proved the dependability of Leadite under most all conditions of bell and spigot water main construction.

THE LEADITE COMPANY
Girard Trust Co. Bldg., Philadelphia 2, Pa.

No Caulking

M-SCOPE





BURIED PIPE AND CABLE FINDER

16 PAGE BOOKLET FREE UPON REQUEST

FISHER RESEARCH LABORATORY
Palo Alto, California

MUELLER COLUMBIAN

IF YOU WANT THE FINEST FIRE HYDRANT MADE—ONE THAT HAS ALL THE DESIRED FEATURES—ONE THAT PERFORMS DEPENDABLY YEAR AFTER YEAR WITH A MINIMUM OF UPKEEP . . . GET MUELLER COLUMBIAN IMPROVED FIRE HYDRANTS

MUELLER CO.
CHATTANOOGA, TENN.

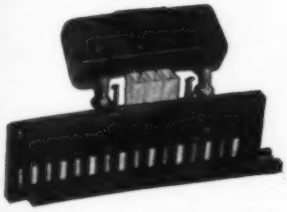
GOLDEN-ANDERSON
Design and Build
OVER 1500
TYPES AND SIZES IN
AUTOMATIC
VALVES
For Engineered Protection
on any HIGH PRESSURE
INSTALLATION

- **Make Golden-Anderson Valves your first choice on any new or replacement project—for maximum safety, dependability and protection.**

Descriptive Technical Catalog on request.

GA
GOLDEN-ANDERSON VALVE Specialty Company
PITTSBURGH 22, PA.

CONTROL CHLORINE
to aid
TROUBLE-FREE OPERATION!



The Taylor-Enslow Slide Chlorimeter determines free and residual chlorine of water, sewage or industrial wastes in sixty seconds . . . with absolute accuracy. Has a range of 0.0 to 1.0 or 0.0 to 3.0 ppm depending upon slide purchased. Operation of set is extremely simple. Standards (which are completely enclosed in plastic slide) carry an UNLIMITED GUARANTEE AGAINST FADING. Taylor pH standard slides may be used on the same base. Combination pH and Chlorine sets (Models L and S) available.

Taylor-Enslow Slide Chlorimeter, with either standard range mentioned above, only $18.50. *In wooden carrying case,* $23.50.

See your dealer, or write direct for free 88-page book, "Modern pH and Chlorine Control".

W. A. TAYLOR AND CO.
7308 YORK RD. • BALTIMORE 4, MD.

MR. SUPT:—

Sure! You can superchlorinate and avoid high residual chlorine taste when—

you post-treat with Virginia's "ESOTOO".

Write us today.

VIRGINIA SMELTING COMPANY
WEST NORFOLK, VIRGINIA

NOTICE TO CONTRACTORS
By
THE DEPARTMENT OF WATER WORKS OF THE CITY OF HAMMOND
Regarding
CONSTRUCTION OF THE EXTENSION TO THE WATER FILTRATION PLANT

Notice is hereby given that sealed proposals endorsed "Proposals for the Construction of the Extension to the Water Filtration Plant" will be received by the Board of Trustees of the Department of Water Works of the City of Hammond, Indiana, at their office in the City Hall, 5941 Calumet Avenue, Hammond, Indiana, until 8 P.M., Central D.S. Time on the 5th day of August, 1946, at which time said proposals will be publicly opened and read aloud. Any bids received later than the above time will be returned unopened.

The work shall be performed in full accordance with the Plans and specifications now on file in the office of said Board. All bids shall be lump sum bids. The Contract will be awarded by the Owner on the basis of the lowest monitary lump sum bid price submitted in the prescribed manner by a qualified bidder.

Proposals shall be executed on the Standard Proposal Form and shall be accompanied by a non-collusion affidavit as required under the statutes of the State of Indiana. Each proposal shall also be accompanied by Standard Questionnaire Form No. 96-a, prescribed by the Indiana State Board of Accounts and by an acceptable certified or cashier's check made payable to the Board of Trustees of the Department of Water Works, Hammond, Indiana, or by an acceptable bidder's bond in an amount equal to not less than five per cent (5%) of the total bid price.

The Contractor to whom the work is awarded will be required to furnish a surety bond acceptable to the Board of Trustees of the Department of Water Works in amount equal to one hundred per cent (100%) of the contract price. Each bidder shall be prepared to promptly enter into a construction contract, furnish surety bond, and to commence the work in accordance with the provisions of the Instructions to Bidders and the Specifications, in the event that the award of the Construction Contract is made to him.

Wage rates to be paid by the Contractor on this work shall not be less than the prescribed scale of wages as determined pursuant to the provisions of Chapter 319 of the Acts of the General Assembly of Indiana of 1935.

No bidder may withdraw his proposal within a period of thirty (30) days following the date as established herein for receiving formal proposals. The Board of Trustees of the Department of Water Works reserves the right to hold any and all proposals for a period of not to exceed thirty (30) days, said proposals to remain in full force and effect during said period.

Specifications and Plans for the work, including the General conditions, Instructions to Bidders, Wage Rates, Special Requirements and facsimilie of contract documents, are on file in the office of the Board of Trustees of the Department of Water Works. Copies of the Specifications and Plans may be obtained from the Board of Trustees at their office in the City Hall, 5941 Calumet Ave., Hammond, Indiana, upon the payment of twenty-five dollars ($25.00) for the set.

The full amount of the deposit for one set of copies of the Specifications and Plans will be refunded to each actual bidder on the work who submits a bona fide bid and who returns the said copies in good condition within five (5) days after the date of receiving bids. One-half (½) of the amount of the deposit for one set of copies of the Specifications and Plans will be refunded to each original recipient of a set of copies of the Specifications and Plans who does not submit a bona fide bid direct to the Board of Trustees, if the said copies are returned in good condition within five (5) days after the date of receiving bids.

The Board of Trustees of the Department of Water Works reserves the right to reject any and all proposals and to waive informalities in bidding.

Dated this 3rd day of June, 1946.
Department of Water Works,
Hammond, Indiana.
By The Board of Trustees,
Herman Scurfield
Steven D. Moskoff
Kenneth H. Moye
Charles O. Schonert
Dr. R. O. Ostrowski

Attest:
Steven D. Moskoff, Secretary
Dated: June 3, 1946.

WRITE FOR INFORMATION

VOGT BROTHERS TRAFFIC MODEL FIRE HYDRANT

A.W.W.A.

VOGT BROTHERS MFG. CO.
MAIN AT 14th Incorporated LOUISVILLE, KY.
VOGT
VOGT MFG. CO., Incorporated
P. O. BOX 1122 LOUISVILLE, KY.

AERO-MIX

AERATOR—MIXER

A Size and Type to Fit Your Problem In Water or Sewage Treatment.

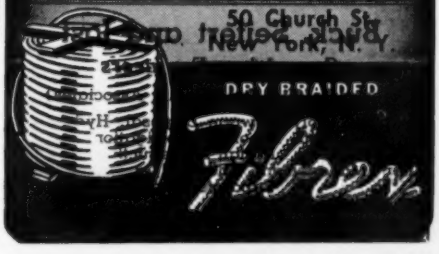
WRITE FOR INFORMATION

HYDRO-TITE

HYDRO-TITE — The self-caulking joint compound that makes cast iron water pipe joints — strong — tight — flexible and everlasting. Used on thousands of miles of pipe with a record of more than 30 years without a failure.

FIBREX — The sanitary paper packing that is used like braided OAKUM. Free from bacteria — treated with a water repellent —put up in 60 pound reels. 50 pounds of Fibrex takes the place of 100 pounds of braided.

HYDRAULIC DEVELOPMENT CORPORATION
50 Church St.
New York, N. Y.



Consulting Engineers

SPECIALIZING IN THE FIELD OF

WATER & SEWAGE WORKS

ALBRIGHT & FRIEL, INC.

Consulting Engineers

Water, Sewage and Industrial Waste Problems — Airfields, Refuse Incinerators, Power Plants — Industrial Buildings
City Planning - Reports - Valuations

Laboratory

1520 Locust Street, Philadelphia 2

Alvord, Burdick & Howson

Engineers

Charles B. Burdick
Louis R. Howson
Donald H. Maxwell

Water Works, Water Purification, Flood Relief, Sewerage, Sewage Disposal, Drainage, Appraisals, Power Generation

Civic Opera Building — Chicago

Michael Baker, Jr.

The Baker Engineers

CIVIL ENGINEERS AND PLANNERS
MUNICIPAL ENGINEERS

Airport Design—Sewage Disposal Systems
Water Works Design and Operation
Consulting Services - Surveys and Maps

HOME OFFICE—ROCHESTER, PA.

W. H. & L. D. BETZ

CONSULTANTS ON ALL WATER PROBLEMS

Process, Boiler and Municipal Water • Waste and Sewage Treatment • Consultation • Design • Analysis

PHILADELPHIA 24, PENNA.

Black & Veatch

Consulting Engineers

4706 Broadway, Kansas City, Mo.

Sewerage, Sewage Disposal, Water Supply, Water Purification, Electric Lighting, Power Plants, Valuations, Special Investigations, Reports and Laboratory Service

E. B. Black — N. T. Veatch, Jr.
A. P. Learned — H. F. Lutz
F. M. Veatch — R. E. Lawrence
E. L. Filby — J. F. Brown

BOGERT-CHILDS ENGINEERING ASSOCIATES

CONSULTING ENGINEERS

Chilton L. Bogert — John M. M. Greig
Howard J. Carlock — Fred S. Childs

Water Supply and Purification
Sewerage and Sewage Treatment
Flood Control and Drainage
Refuse Disposal
City Planning—Investigations—Reports

624 Madison Avenue, New York 22, N. Y.

Buck, Seifert and Jost

Consulting Engineers

(Formerly Nicholas S. Hill Associates)

Water Supply, Sewage Disposal, Hydraulic Developments, Reports, Investigations, Valuations, Rates, Design Construction Operation Management, Chemical and Biological Laboratories

112 East 19th St. — New York

BURNS & McDONNELL ENGINEERING COMPANY

McDonnell-Smith-Baldwin-McDonnell

Consulting Engineers Since 1897

Water Works, Light & Power, Sewerage, Rate Investigations, Reports, Designs, Appraisals.

Kansas City, Mo. — 107 W. Linwood Blvd.

THOMAS R. CAMP

Consulting Engineer

6 Beacon Street, Boston 8, Mass.

Water Works and Water Treatment; Sewerage and Sewage Treatment; Municipal and Industrial Wastes; Investigations and Reports; Design and Supervision; Research and Development; Flood Control.

The Chester Engineers

Water Supply and Purification, Sewerage and Sewage Treatment, Power Development and Applications, Investigations and Reports, Valuations and Rates.

210 E. Park Way at Sandusky,
Pittsburgh 12, Pa.

Collins Engineering Company

—Consulting Engineers—

Water Supply, Purification, Sewerage, Sewage Treatment, Refuse Disposal, Industrial Wastes, Street Paving, Storm Drainage

326 Arnote Building — 314 Gilbert Building
McAlester, Oklahoma — Ardmore, Oklahoma

DE LEUW, CATHER & COMPANY

Water Supply — Sewerage
Railroads — Highways
Grade Separations—Bridges—Subways
Local Transportation

Investigations — Reports — Appraisals
Plans and Supervision of Construction

20 North Wacker Drive — Chicago

FAY, SPOFFORD & THORNDIKE

Engineers

Charles M. Spofford

John Ayer — Carroll A. Farwell
Bion A. Bowman — Ralph W. Horne

Water Supply and Distribution — Drainage
Sewerage and Sewage Treatment—Airports
Investigations and Reports
Designs — Valuations
Supervision of Construction

Boston — New York

Edward A. Fulton

Consulting Engineer

Investigations, Reports, Valuations, Design and Construction—Water Supply and Purification Plants, Sewerage and Sewage Treatment Works; Municipal Paving and Power Developments.

3 So. Meramac Ave.
St. Louis, Mo.

GANNETT FLEMING CORDDRY AND CARPENTER, INC.

Harrisburg, Pa. — New York, N. Y.

ENGINEERS

Water Works, Sewage, Industrial Wastes & Garbage Disposal—Roads, Airports, Bridges & Flood Control. Town Planning, Appraisals, Investigations & Reports.

I. M. Glace

Consulting Sanitary Engineer

WATER SUPPLY AND PURIFICATION
SEWERAGE AND SEWAGE TREATMENT

Specializing in Water Quality Problems

Telephone 6-0407 — 1001 North Front St. Harrisburg, Pa.

WILLIAM A. GOFF

Consulting Engineer

Water, Sewerage, Refuse Incinerators, Industrial Buildings, Power Plants, Investigations Reports Design Supervision of Construction Valuations

Broad St. Station Bldg., Philadelphia 3, Pa.

GREELEY AND HANSEN

Engineers

Samuel A. Greeley — Paul Hansen (1920-1944)
Paul E. Langdon — Kenneth V. Hill
Thomas M. Niles — Samuel M. Clarke

Water Supply, Water Purification
Sewerage, Sewage Treatment
Flood Control, Drainage, Refuse Disposal

220 S. State Street, Chicago 4
180 Broadway, New York 7

Havens and Emerson

W. L. Havens — C. A. Emerson
A. A. Burger — F. C. Tolles — F. W. Jones

Consulting Engineers

Water, Sewage, Garbage, Industrial Wastes, Valuations — Laboratories

Leader Building, Cleveland 14 — Woolworth Bldg. New York 7

Hayden, Harding & Buchanan

Consulting Engineers

John L. Hayden — Gordon E. MacNeill
John H. Harding — Oscar J. Campia

Waterworks, Sewerage, Civil, Mechanical, Electrical, Structural

662 Park Square Building, Boston, Mass.

Charles Haydock

Consulting Engineer

Water Works and Sanitation, Industrial Wastes, Design, Construction, Operation and Management. Reports and Valuations.

COMMERCIAL TRUST BUILDING
PHILADELPHIA 2

JONES & HENRY

Formerly H. P. JONES & CO.

Harvey P. Jones — Thomas B. Henry

Consulting Engineers

Reports, Designs, Supervision, Valuation
Water Supply — Refuse Disposal
Water Purification — Industrial Wastes
Sewerage — Flood Control
Sewage Treatment — Drainage
Security Bldg. — Toledo 4, Ohio

Morris Knowles, Inc.

Engineers

Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning

1312 Park Building, Pittsburgh, Pa.

CHARLES D. LEHMAN

Consulting Engineer

Emergency Communications
Surveys & Reports, Plans & Specifications
Operation and Maintenance Problems

Box 257 — Flossmoor, Illinois

Wm. S. Lozier, Inc.

Consulting Engineers

Wm. S. Lozier - C. E. Elmdorf - A. B. Squire
Sewerage, Sewage Disposal, Water Supply, Water Purification, Refuse Disposal

10 Gibbs Street, Rochester, N. Y.

Metcalf & Eddy

Engineers

Water, Sewage, Drainage, Refuse and Industrial Waste Problems
Airfields — Valuations
Laboratory

Statler Building, Boston

MURRAY LABORATORY

25 years experience

Consulting—Analytical—Chemist—Bacteriologist. Municipal and Industrial Water Supplies

Bacteriological — Chemical — Sanitary — Mineral Analyses. Reports and Treatment Recommendations.

Capers Bldg.—Greenville, South Carolina

Nussbaumer and Clarke

Newell L. Nussbaumer — Irving Clarke

Water Supply and Treatment
Sewerage & Sewage Disposal
Garbage Incineration
Town Planning

327 Franklin St. — Buffalo, N. Y.

Parsons, Brinckerhoff, Hogan & Macdonald

Engineers

Traffic Reports — Valuations — Harbor Works
Power Developments — Industrial Buildings
Bridges — Tunnels — Subways — Foundations
Dams — Water Works — Sewerage

142 Maiden Lane, New York 7
Calle Sur 17 No. 27, Caracas, Venezuela
Edificio Suarez Costa, Bogota, Colombia

Malcolm Pirnie Engineers

Civil & Sanitary Engineers

Malcolm Pirnie — Ernest W. Whitlock
Robert W. Sawyer — G. G. Werner, Jr.
Richard Hazen

Investigations, Reports, Plans
Supervision of Construction and Operations
Appraisals and Rates

25 West 43rd St., New York 18, N. Y.

The Pitometer Company

Engineers

Water Waste Surveys, Trunk Main Surveys, Water Distribution Studies

Penstock Gaugings

New York, 40 Church St.

ROBERT T. REGESTER

Consulting Engineer

Water Works — Sewage Treatment
Hydraulic Structures — Utilities

Baltimore Life Bldg. — Baltimore 1, Md.

Thomas M. Riddick

Consulting Engineer and Chemist

Municipal and Industrial Water Purification, Sewage Treatment, Operating Supervision of Plants, Sanitary Surveys, Stream Pollution Investigation, Swimming Pool Control, Chemical and Bacteriological Analyses, Testing of Materials.

369 East 149th Street, New York City

ROBERT AND COMPANY

INCORPORATED

Architects and Engineers

WASHINGTON · ATLANTA · NEW YORK

WATER SUPPLY — INCINERATORS
SEWAGE DISPOSAL — POWER PLANTS

OVER HALF A CENTURY IN CHICAGO

EDGAR A. ROSSITER

CONSULTING ENGINEER

WATER WORKS — Sewerage

Municipal Engineering — Farm Drainage

DES PLAINES, ILL.

Russell & Axon

Geo. S. Russell—John C. Pritchard
Joe Williamson, Jr. — F. E. Wenger

Consulting Engineers, Inc.

Sewerage, Sewage Disposal, Water Works, Filtration, Softening
Power Plants

6835 Delmar Blvd University City 5, Mo.

J. E. Sirrine & Company

Engineers

Water Supply & Purification
Sewage & Industrial Waste Disposal
Stream Pollution Reports
Utilities, Analyses

Greenville — South Carolina

WHITMAN, REQUARDT AND ASSOCIATES

Engineers — Consultants

Civil—Sanitary—Structural—Mechanical—Electrical. Reports, Plans, Supervision, Appraisals

1304 St. Paul Street
Baltimore 2, Maryland

Benjamin L. Smith & Associates

Engineers

(Formerly Whitman and Smith)

Investigations — Reports
Designs — Supervision — Valuations
Municipal Engineering and Public Utilities

11 North Pearl Street
Albany 7, New York

STANLEY ENGINEERING COMPANY *Consulting Engineers*

Water Works — Sewerage
Electric Power — Flood Control
Rate Studies—Valuations—Industrial
Airports . . . Municipal Buildings

Hershey Bldg., Muscatine, Ia.

PHILIP B. STREANDER AND AFFILIATES

CONSULTING SANITARY ENGINEERS

Damon and Foster, Engrs.
Sharon Hill, Del. Co., Pa.

Cleverdon, Varney & Pike, Engrs.
120 Tremont St., Boston 8, Mass.

Water Supply, Treatment, Distribution
Trade Wastes, Refuse Disposal
Sewerage, Sewage Treatment
Plans, Supervision, Reports

Westcott & Mapes, Inc.

Architects and Engineers

Sewage Disposal
Garbage and Refuse Incineration
Public Utilities
Reports — Plans — Specifications

NEW HAVEN — CONN.

Weston & Sampson

Water Supply, Water Purification, Sewerage, Sewage and Industrial Waste Treatment, Corrosion Control, Laboratory Service, Supervision, Valuations

14 Beacon St. — Boston, Mass.

Whitman & Howard

Engineers (Est. 1869—Inc. 1924)

Channing Howard — Paul F. Howard
Walter A. Janvrin — C. Roger Pearson

Water Supply, Water Purification, Sewerage, Sewage Disposal, Water Front Improvements and all Municipal and Industrial Development Problems, Investigations, Reports, Designs, Supervision, Valuations.

89 Broad St., Boston, Mass.

WHEN YOU VISIT MODERN MEXICO CITY

In and near Mexico City, you will find many fine, time proven Layne Well Water System installations. A partial tabulation shows Layne Well Water Systems serving Mexico City, an Automobile Assembly Plant, a large Chemical and Pharmaceutical works, Tire and Rubber Companies and extensive Irrigation Projects in the Valley of Mexico adjacent to Mexico City. As in the States — and elsewhere throughout the world — these Mexico installations are giving highly efficient and exceptionally dependable service.

Layne Well Water Systems are designed and built to exceed the usual passable quality mark. Company policy has never been to allow corner cutting in quality or skillful manufacture. Such a policy has made Layne Well Water Systems world famous and given owners immeasurable satisfaction.

If you are in need of a new water system, late literature should be read very carefully. Address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

HIGHEST EFFICIENCY

Layne Vertical Turbine pumps are available in sizes to produce from 40 to 16,000 gallons of water per minute. High efficiency saves hundreds of dollars on power cost per year.

AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. * Layne-Atlantic Co., Norfolk, Va. * Layne-Central Co., Memphis, Tenn. * Layne-Northern Co., Mishawaka, Ind. * Layne-Louisiana Co., Lake Charles, La. * Louisiana Well Co., Monroe, La. * Layne-New York Co., New York City * Layne-Northwest Co., Milwaukee Wis. * Layne-Ohio Co., Columbus, Ohio * Layne-Texas Co., Houston, Texas * Layne-Western Co., Kansas City, Mo. * Layne-Western Co. of Minnesota, Minneapolis, Minn. * International Water Supply Ltd., London, Ontario, Canada * Layne-Hispano Americana, S. A., Mexico, D. F.

LAYNE

WELL WATER SYSTEMS
VERTICAL TURBINE PUMPS

Index TO ADVERTISERS

Albright & Friel, Inc. 138
Alvord, Burdick & Howson 138
*American Brass Co. 109
American Car & Fdry. Co. 46
*American Radiator & Standard Sanitary 134
*Anthracite Equipment Co. 120
Armco Drainage & Metal Products, Inc. 110
*Atlas Mineral Products Co. of Pa., The 50
Aurora Pump Co. 119

*Bailey Meter Co. 124
Baker, Jr., Michael 138
Belco Industrial Equip. Division 40
Betz, W. H. & L. D. 138
Black & Veatch 138
Bogert-Childs 138
Briggs Bitumen Co., W. A. 119
Buck, Seifert & Jost 138
*Builders Iron Foundry 49
*Builders-Providence, Inc. 49
Burns & McDonnell 138
Byers Co., A. M. 37

Calgon, Inc. 35
Camp, Thos. R. 138
Carborundum Co. 31
*Carter Co., Ralph B. 115
Cast Iron Pipe Research Assn. 8-9
Cement Gun Co. 131
Centriline Corp. 24
Champion Corp. 106
Chapman Valve Mfg. Co., The ..... Second Cover
Chemical Feeders Div. 135
Chemical Equip. Co. 133
Chester Engineers, The 138
*Chicago Bridge & Iron Co. 13
*Chicago Pump Co. 105
Clark Controller Co. 11
Clayton Mfg. Co. 110
Climax Engr. Co. 27
Collins Engineering Co. 138

Darco Corp. 131
Dean & Co., Payne 134
Dearborn Chemical Co. 28
De Laval Steam Turbine Co. 6
DeLeuw, Cather & Co. 138
Diamond Alkali Co. 39
Dorr Company, Inc., The ..... Third Cover

Eddy Valve Co. 121
Edson Corp., The 122
Electro Rust-Proofing Corp. 106

Fairbanks-Morse 10
Fay, Spofford & Thorndike 138
Fisher Research Laboratory 136
*Flexible Sewer Rod Equipment Co. 26
*Flexible Underground Pipe Cleaning Co. 26
Ford Meter Box Co. 123
Foxboro Co. 18
Fulton, Edw. A. 138

Gannett, Fleming, Cordy & Carpenter Inc. 138
Gardner-Denver Co. 12
General Chemical Co. 33
General Electric Co. 16-17
*General Paint Corp. 118
Glace, I. M. 138
Glauber Brass Mfg. Co. 111
Goff, Wm. A. 138
*Golden-Anderson Valve Spec. Co. 136
Gorman-Rupp Co. 14
Greeley & Hansen 138
Grinnell Co. 114

Havens & Emerson 138
Hayden, Harding & Buchanan 138
Haydock, Chas. 138
Hellige, Inc. 119
*Hill, Hubbell & Co. Div. 118
Homelite Corp. 22
*Hooker Electrochemical Co. 117
Hydraulic Development Corp. 42-43-137

Inertol Co. 116
*Infilco, Inc. 130
Iowa Mfg. Co. 119

*Johns-Manville 38-107
Jones & Henry 138

Knowles, Inc., Morris 139

Lapp Insulator Co. 47
Lakeside Engr. Corp. 134
Layne & Bowler, Inc. 140
Leadite Co., The 136
Lehman, Chas. D. 139
Leupold & Stevens 133
Lock Joint Pipe Co. 21
Lozier, Inc., Wm. S. 139

Mathews Hydrants 139
Mathieson Alkali Wks., Inc. 29
McAlear Mfg. Co. 45
Metcalf & Eddy 139
Meter Specialty Co. 122
Morse Boulger Destructor Co. 135
Mueller Co. 136
Murray Laboratory 139

National Clay Pipe Mfrs., Inc. 44
National Technical Laboratories 41
*National Water Main Cleaning Co. 136
Neptune Meter Co. 52
Niagara Alkali Co. 19-20
*Northrop & Co., Inc. 126
Nussbaumer & Clarke, Inc. 139

*Omega Machine Co. (Division of Builders Iron Fdry.) 122

*Pacific Flush Tank Co. 134
Parsons, Brinckerhoff, Hogan & Macdonald 139
Payne Dean Co. 134
Peerless Pump Division (Food Machinery Corp.) 128
*Pennsylvania Salt Mfg. Co. 7
*Permutit Co. 116
*Philadelphia Quartz Co. 127
Phipps & Bird, Inc. 120
Pirnie, Malcolm 139
Pitometer Co., The 139
Pittsburgh Equitable Meter Co. 3
*Pittsburgh-Des Moines Steel Co. 48
*Pittsburgh Plate Glass Co. (Columbia Chemical Div.) 15
*Proportioneers, Inc. 115

Regester, Robt. T. 139
*Riddick, Thomas M. 139
Ridge Tool Co. 117
Robert & Co. 139
Roberts Filter Mfg. Co. 128
Rockwell Mfg. Co. 3
Rodney Hunt Mach. Co. 119
Roots-Connersville Blower Corp. 125
*Ross Valve Mfg. Co. 135
Rossiter, Edgar A. 139
Russell & Axon 139
*Royer Fdry. & Machine Co. 25

Sanequipment Engineering 136
*Simplex Valve & Meter Co. 108
Sirrine & Co., J. E. 139
Smith & Associates, Benj. L. 139
Smith Mfg. Co., The A. P. 30
Smith Co., S. Morgan 36
*Sparling, R. W. 124
Stacey Bros. Gas Constr. Co. 112
Stanley Engineering Co. 139
Streander, Philip B. 139
*Stuart Brumley Co. 118

Tate Pipe Linings, Inc. 132
Taylor & Co., W. A. 137
*Tennessee Corp. 126
Thomson Meter Co. 52

U. S. Pipe & Fdry. Co. 23

*Vapor Recovery Systems Co. 32
Victaulic Co. of America 129
Virginia Smelting Co. 137
Vogt Bros. Mfg. Co. 137
Vogt Manufacturing Co. 137

*Wallace & Tiernan Co., Inc. ..... Back Cover
War Assets Administration 113
Warren Foundry & Pipe Corp. 132
Westcott & Mapes, Inc. 139
Westinghouse Electric Corp. 4-5
Weston, L. A. 124
Weston & Sampson 139
Whitman & Howard 139
Whitman, Requardt & Associates 139
Wood Co., R. D. 120
Worthington-Gamon Meter Co. 34

Zeolite Chemical Co. 126

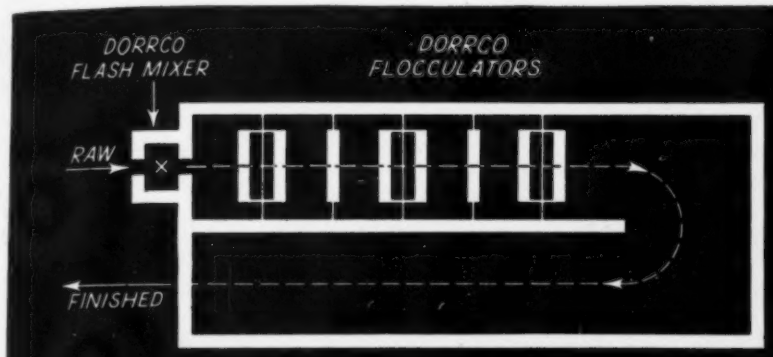
*Advertisers with * were represented in the April, 1946, Convention and Data Edition with catalog specification copy. Please refer to that issue for additional information on behalf of their products.

BIG ECONOMIES

IN NEW JERSEY

With Dorr-equipped water treatment system

Comparative figures reveal the outstanding economies effected with Dorrco Flocculators and a Dorrco Flash Mixer at the Little Falls, N. J., Plant of the Passaic Valley Water Commission.



SKETCH SHOWING MODERNIZATION PROGRAM DESCRIBED IN THIS ADVERTISEMENT

SAVED 16.8% on ALUM

SAVED 22.8% on LIME

SAVED 58.7% on BACKWASH WATER

GAINED 191% on FILTER RUNS

THIS complete water treatment system was installed in existing tank facilities and *required no new tank construction*. It uses one Dorrco Flash Mixer and five rows of Dorrco T-Type Flocculators. At this rate of savings the equipment will pay for itself in about four years.

Morris Knowles, Inc., of Pittsburgh, consulting engineers, in collaboration with Richard E. Bonyun and Warren W. Currens, superintendents of the Passaic Valley Water Commission, achieved these savings on a water volume of over 25 million gallons per day. This is how a quantitative comparison of the old system and the new Dorr system looks:

	OLD SYSTEM 1944*		DORR SYSTEM 1945*	
	Raw Water	Finished Water	Raw Water	Finished Water
MGD	26.3		25.3	
Turbidity ppm	8	1	8	0
Color ppm	35	7	34	6
pH	7.1		7.0	
CHEMICAL DOSING				
Alum (gr./gal.)	1.71		1.41	
Lime (gr./gal.)	0.78		0.65	
FILTER OPERATION				
Length of Runs (hours)	38.6		112.1	
% Wash Water	1.7		0.7	

*Three months' average—October, November, December.

Experienced Dorr representatives can assist your engineer in the design of a new, modern water treatment system—or put new economy into your present treatment plant. As a first step to water treatment economy, consider proven equipment, Dorr equipment.

DORRCO 900

THE DORR COMPANY, ENGINEERS

NEW YORK 22, N. Y. . . 570 LEXINGTON AVE.
ATLANTA 3, GA. . . WILLIAM-OLIVER BLDG.
TORONTO 1, ONT. . . . 80 RICHMOND ST. W.
CHICAGO 1, ILL. . . . . 221 NO. LA SALLE ST.
DENVER 2, COLO. . . . . COOPER BUILDING
LOS ANGELES 14, CAL. . . . 811 WEST 7TH ST.

RESEARCH AND TESTING LABORATORIES
WESTPORT, CONN.

SUGAR PROCESSING
PETREE & DORR DIVISION
570 LEXINGTON AVE., NEW YORK 22

DORR

RESEARCH · ENGINEERING · EQUIPMENT

ADDRESS ALL INQUIRIES TO OUR NEAREST OFFICE

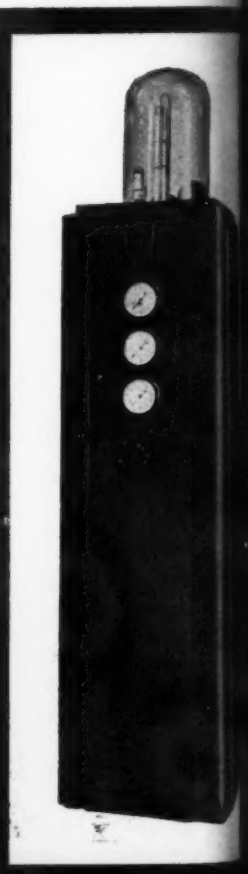
Your best friends will tell you

Yes, even your best friend *will* tell you about objectionable sewage plant odors. But there's no need to risk their ire, and possible law suits — not when properly applied chlorination can nip the trouble at its source.

Your W & T Representative has the experience, the technical ability and the right equipment to engineer a chlorinator installation to your particular needs. The W & T Chlorinator he installs will be accurately tailored to your plant requirements to banish odor problems and give you chlorination's other advantages too. Call him today.

"The Only Safe Sewage is a Sterilized Sewage"

SA198



WALLACE & TIERNAN COMPANY, INC.

MANUFACTURERS OF CHLORINE AND AMMONIA CONTROL APPARATUS

NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES